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WORKING PLAN

FOR THE

TINNEVELLY *CUM* RAMNAD FOREST DIVISION

1934-35 TO 1943-44

BY
E. A. LASRADO, Esq., M.A., I.F.S.
Deputy Conservator of Forests and Working Plans Officer

UNDER THE DIRECTION OF
C. C. WILSON, Esq., I.F.S.
Conservator of Forests, Working Plans Circle

MADRAS
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

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WORKING PLAN FOR THE TINNEVELLY CUM RAMNAD DIVISION.

PART I.

Summary of facts on which proposals are based.

CHAPTER I.—GENERAL DESCRIPTION.

SECTION 1.—NAME, SITUATION AND OWNERSHIP.

1. *General.*—The Working Plan covers all the Reserved Forests of the Tinnevelly *cum* Ramnad Forest Division, which well be referred to hereafter as " the division," in order to distinguish it from the two revenue districts of Tinnevelly and Ramnad. It covers an area of 258,997·67 or 404·68 square miles.

2. *Position.*—The division is situated between 8° 21′ 20″ and 9° 38′ 20″ North Latitude, and 77° 12′ 42″ and 78° 5′ 21″ Longitude East of Greenwich.

SECTION 2.—PHYSICAL DESCRIPTION.

3. *General.*—The bulk of the forest is situated on the eastern water-shed of the Travancore extension of the great irregular chain of the Western Ghats which in this division attain comparative regularity. Save for a break near the Shencottah gap, they march southward in an unbroken line from the northern limit of the Tinnevelly District as far as the Tambaraparni valley; thence sweeping for 12 miles in a bold curve towards the South-East, they once more resume their southward trend to the sea.

4. *Chief peaks.*—Along the skyline the mountains average approximately 5,000 feet, more than a score of peaks exceeding this height; conspicuous among these are Kottaimalai 6,624 feet and Vellimalai 6,154 feet both at the trijunction of the Tinnevelly, Ramnad and Madura districts, the Kallakadai mottai 5,721 feet above Sivagiri, and Kuliratti 5,876 feet towering up behind Krishnapuram; southward from this point the hills decrease in height, the main range dropping rapidly to the Achenkoil and Ariankavu passes. Recovering again, they climb rather abruptly and culminate in the splendid peak of Panjantangi 5,135 feet above Kuttalam and the General's Hill 4,439 feet on the border of the Tenkasi and Ambasamudram taluks. Here the ghats begin to widen out, and above Papanasam the range attains its maximum thickness of 13½ miles. The country falls to the plains from the great range of high rugged mountains which mark the water-shed, in a series of precipitous slopes, with a variety of aspects, intersected by numerous rivers and streams. Interspersed are undulating plateaux of comparatively small extent, such as the Mundanthorai plateau in Ambasamudram Range. The most striking of this mass of mountains is Agastyamalai 6,125 feet, the fabled abode of the famous *rishi* Agastya, unfortunately ceded to Travancore in 1928. A perfect cone in shape, standing on a low base in a wide gap of the skyline, it is a magnificent sight when seen from the plains. Adjacent to it is the Ainthalai Pothigai in Singampatti Zamin. This peak marks the turn of the water-shed to the South-East as far as the Nanguneri frontier. The hills in Nanguneri range lose in width and are more precipitous. Above Tirukurangudi they tower up to 6,000 feet, dropping at the Nadugani gap to 3,000 feet only to rise again to the Mahendragiri range 5,427 feet which ends abruptly in a magnificent scarp of bare precipitous rock known as Tiruvanamalai 4,610 feet.

5. *Zamindari forests.*—A number of Zamindari forests dovetail with the Government forests along the ghats. The principal among these are the Singampatti Zamin in Ambasamudram taluk, the Vairavankulam Zamin in Tenkasi taluk, and the Sivagiri Zamin in Sankarankoil taluk. This factor complicates the efficient management of the Government forests enormously, as irregular working of the Zamin forests tends to produce wide fluctuations in the prices obtainable for forest produce in the adjacent Government reserves. Besides, the lack of silvicultural and other restrictions in the working of Zamin forests, tends to attract contractors away from work in the Government forests.

6. *Plain forests.*—A prominent feature of the Tinnevelly-Ramnad plains is the numerous isolated hillocks which tend to break the monotony of an otherwise depressing landscape. Of these a few have been constituted reserves, with the object of ensuring the supply of fuel and grazing to the surrounding village communities. The Vallanad reserve

in Srivaikuntam Taluk, the Kolundamamalai and Manpottai reserves in Ambasamudram taluk, and the Valaikulam and Sappaniparambu reserves in Srivilliputtur Taluk are examples of such reserves.

7. *Sand dunes.*—The Kudiraimozhi Teri Reserve in Tiruchendur Taluk is a large block of about 12,000 acres consisting of extensive dunes of loose shifting red sand, the reclamation of which has provided the Forest Officer with a very interesting but difficult problem.

8. *River systems.*—The hydrology of the division is simple as all the rivers flow East or South East. The importance of the ghat forests as catchment areas of the various streams and rivers which irrigate the plains, cannot be overestimated. The main rivers in the division which are also important irrigation sources are—

(1) The Tambaraparni, the chief river of the division, drains with its tributaries an area of about 1,750 square miles and from its source in the Periya Pothigai, to its mouth in the Gulf of Mannar is 75 miles long. Owing to its extensive catchment area in the ghats, it enjoys the full benefit of both monsoons and its bed is never dry. Its chief tributaries in the ghats are the Peyar, Ullar, Kariar and Serviar in the Government Forests and the Pambar in Singampatti Zamin. In the plains the first tributary to join the river is the Manimuttar which, rising in deep shola above Sengalteri, is reinforced by the Varattar and Kusanguliar. It is the principal source of irrigation to the Singampatti zamin. The next affluent is the Varahanadhi which brings down the joint waters of the Ramanadhi and the Jambunadhi, both the latter having their sources in the hills above Mela Kadayam. The Gatanadhi into which flow the waters of the Kalar and Karunai Ar from the Sivaisalem Hills, joins the Varahanadhi near Pappankulam and flows into the Tambaraparni on its left bank at Tiruppudaimarudur. The Pachaiyar, rising in the hills above Terkuviravanallur, joins the Karumandiaman channel and irrigates portions of the Nanguneri and Tinnevelly taluks before joining the Tambaraparni. The last affluent, the Chittar, rises in the hills above Kuttalam, into which it precipitates itself in a succession of beautiful falls. Its catchment basin in the hills being small, floods descend rapidly and the river is dependent for its supply, on the vast area, which it drains in the plains. It joins the Tambaraparni at Sivalapperi after irrigating some 27,000 acres in the Tenkasi and Tinnevelly taluks.

(2) South of the Pachaiyar basin the Nanguneri Taluk is drained by the Nambiyar and its tributaries the Narakadu Ar, and the Kodamadi Ar. This river reaches the plains at Tirukurangudi and is generally in flood only in the north-eastern monsoon, the "freshes" received in the south-west monsoon extending only to the foot of the hills where they are utilized extensively for wet cultivation.

(3) North of the Chittar basin in the Sankarankoil Taluk, are from South to North the Hanumanadhi, the Kuliratti Ar, Kottaimalaiyar and Rasinga Ar; the water they bring down from the hills in October to January is almost entirely absorbed by a network of tanks.

(4) Finally in the Srivilliputtur Taluk, we have the Mudangiar, the Athithondu Ar, the Chittar, and the Periyar, all fed principally by the north-east monsoon.

9. *Importance of river systems.*—With the exception of the Tambaraparni very little of the waters of the other rivers enumerated find their way to the sea. The rivers are thus of the greatest importance not only because their lower reaches pass through cultivated land but also because they all serve as feeders to the large network of tanks which are such a characteristic feature of the irrigation system of the division.

10. *The Papanasam Reservoir Project.*—So long ago as the thirties of the last century, a project for providing a reservoir in the upper reaches of the Tambaraparni, by means of which it would be possible to hold up the flood waters of the river and regulate their distribution had been mooted. It was expected that such an arrangement would conserve the water which in times of flood flowed into the sea, and provide a more regular supply to the irrigation system of the river valley, thus contributing towards a reduction of the remissions of land revenue during unfavourable seasons. The idea owed its origin to Col. A. T. Cotton, but it was left to Captain Horsley (1854) to formulate a scheme. His proposal was to throw across the river, about a mile above the Sorimuthayan temple and five miles from the Papanasam fall, a dam 50 feet high and 100 feet broad which would flood the river valley up to the Banathirtam cataract, and store up the waters of the Kariyar and Pambar. The storage thus effected was to be supplemented if necessary by a second lake below the Serviar junction where the river-bed was 300 to 400 feet wide and flowed between high rocky hills. On investigation, an estimate of 1½ lakhs for the Sorimuthayankoil reservoir was prepared and it was calculated that the drainage of 25 square miles would be stored in the basin, and that 8 inches of rainfall would fill the

reservoir. In 1872 further investigation disclosed, that a dam 80 feet high for the reservoir would impound only 22 million cubic yards of water and as this was insufficient, proposals for a reservoir here or higher up the valley were definitely abandoned. In 1875 Major Mullins revived the scheme, and after further investigation decided that the most suitable site for a dam was a spot about a mile above Papanasam, where the river passes in two channels through low rocky hills, the valley above being wide and open. Here he thought that a reservoir of considerable capacity could be built at a moderate cost. The scheme was condemned by engineering opinion on the ground that the area of drainage had been wrongly calculated, and the rainfall statistics incompletely compiled. In 1911 interest was again revived in the scheme, but beyond steps being taken to compile an accurate record of rainfall and the discharge of the river, no progress was made. The subject has since then been periodically revived, thanks mainly to the efforts of the District Irrigation Committee; it has been decided however that as an irrigation project alone the project would not be remunerative, but as a combined hydro-electric and irrigation scheme it would pay handsomely provided that an adequate demand for power was created by the establishment of a paper mill at Ambasamudram, with a capacity of 10,000 tons of pulp per annum. In the absence of private enterpise in this direction, however, the scheme has been shelved indefinitely.

SECTION 3.—GEOLOGY, ROCK AND SOIL.

11. *General.*—The rocks met with during the Geological Survey of the division arranged in descending order are—

(1) Archæan Rocks, Gneisses and Granites.

(2) Gritty sandstones (Cuddalore Sandstones).

(3) Lateritic conglomerates and gravels.

(4) Subrecent marine beds, limestones and grits (upraised coral beds).

(5) Fluviatile and marine alluvia, kankar deposits.

(6) Blown sands red ((teris); white (coast dunes).

(7) Soils and sub-aerial deposits.

12. *The ghats.*—The principal underlying rock throughout the ghat forests, is a granitoid gneissic formation; it is a pale quartzo—felspathic banded rock. containing narrow veins of black mica and intercalated with numerous small pale red or pink garnets. From its large development near Cape Comorin, it has been called the Cape Comorin type. The bedded structure of this rock is admirably displayed in the beautiful Kolundamamalai Hill. Scattered outcrops of hornblendic gneiss, rich in iron, occur in the Manpothai Reserve and in the Sivaisalem and Vasudevanallur hills. Seen at its best, scattered in the Sivaisalem hills, are large patches of a coarse tufaceous conglomerate containing a high percentage of limestone. Water flowing over or percolating through this rock, carries away in solution a great deal of lime which is deposited in stream beds or more picturesquely *in situ*, in the form of stalactites and stalagmites in the interstices of the parent rock. Outcrops of the underlying rocks appear at almost all elevations owing to the rugged nature of the country, and sometimes necessitate the exclusion of appreciable areas from the Small Timber cum Fuel and Fuel Working Circles. Smaller outcrops when present in a coupe also contribute towards a diminution in the price per acre offered for the coupe.

13. *The plains.*—On the plains the most conspicuous outcrops are the numerous masses of granular quartz, fine examples of which are to be seen in the Vallanad reserve, and to a smaller extent in the Valaikulam and Sappaniparambu reserves. The rock approaches in appearance a glassy quartzite, the granular quartz bands being found intercalated with bands of varying thickness of typical granitoid gneiss, which owing to its greater susceptibility to weathering is more extensively denuded.

14. *Soils.*—The two great groups into which the soils of the division may be divided are the *red* and the *black*. The black cotton soil or *regur* is restricted to the cultivated area in the plains and is therefore of little interest to the Forest Officer. The red soils being generally the result of decomposition *in situ* of underlying ferruginous rock, vary considerably in character.

(*a*) Over hornblendic and other ferruginous forms of gneiss, the soil is of *deep red colour* with high iron content. This soil tends to become swampy in the wet weather and hard and baked during the dry weather, possibly due to pan formation at no great depth below the surface. Tree growth, especially teak, does not flourish on such soils.

(*b*) The soil derived from the decomposition of the highly silicious variety of gneiss, i.e., the Cape Comorin type, is more sandy and of *pale red colour*. Where this soil is present in sufficient depth, and the rainfall comparatively abundant, the best deciduous forests are to be met with.

(*c*) The deep red loamy soil to be met with along the foot of the ghats is very probably a pluvial deposit brought down directly from the mountain flanks. Some of the best natural teak forests in the division—the Ayyanarkoil Felling Series—are to be met with on this soil.

(*d*) Along most of the river banks are to be found alluvial deposits, varying in depth and extent according to the frequency of floods and the width and steepness of the river valleys respectively. The soil is usually light red in colour and rather sandy. It has a high lime content usually and this may account for the fact that teak does not thrive on it. It is usually clothed with a good growth of semi deciduous forest species.

(*e*) Near the granular quartz beds the soil is very gritty and light brown in colour, narrow strata of quartz pebbles being found only 1 to 2 feet below the surface. *Albizzia amara* is the principal species on such areas.

(*f*) In the evergreen forests the soil consists mostly of a dark clayey loam—the argillaceous nature being probably due to the disintegration of felspar aided by a plentiful supply of humus.

15. *Aeolian formations.*—There is no part of the Presidency in which blown sands play so large and important a part as in the plains of this division. They are of two kinds differing both in colour and origin—the red sands or teris, the white sands or coast dunes. Of these the former are the more interesting and important—interesting because of the obscurity attaching to their origin, and important, because they comprise the whole of the Kudiraimozhi Teri Reserve. The *teris*, it is believed, owe their origin to the action of heavy and continuous gales, prevailing from May to September during the south-west monsoon. By these fierce winds, the dry surface of the broad belt of red loam which skirts the eastern base of the ghats, is swept clean, and vast clouds of red dust are carried eastward to the coast, and there meeting the fresh sea breezes are precipitated, giving rise to the red sand hills or *teris*. At these times the eastern horizon as seen from the hills, seem to be on fire, so vividly does the evening sun light up the great clouds of dust driving before the monsoon gales. Enormous tongues of flame seem to leap up in the air, while the non-illuminated parts of the dust clouds simulate smoke, the whole scene bearing a marvellous resemblance to a forest fire, for which it is likely to be mistaken by the uninitiated. The *teris* have been deposited upon and around a mass of impermeable marine limestone elevated a varying height above sea level. This accounts for the fact that all rainfall, except the heaviest showers, is absorbed at once, and flows out *below* the sandy layer quietly and continuously; this is especially noticeable along the northern edge of the *teri* where the sandy deposit is shallowest. It is here that advantage is taken of these subterranean springs by the ryots who excavate channels of 12 feet depth and more, to meet these springs and conduct their water for irrigation purposes to field and market gardens which are among the richest in the division. These channels reveal that in many places the percolation of rain-water has given rise to a cementation of the ferruginous and silicious particles into a quasi-lateritic formation. It is well known that the advance of teri sands from time to time has caused damages by burying fields and gardens and even occasionally houses. The rate of advance of the sands in the adjacent Satankulam Teri has been computed by Lieut.-Colonel Branfell of the Great Trigonometrical Survey, to have been 1,000 yards, or nearly 17 yards a year, during the 60 years which elapsed, since Colonel Lambton in 1808–09 fixed his Trigonometrical station on the top of this *teri*. In the four years 1869–74 the advance was only at the rate of six yards per annum. In both cases the direction of advance was the same, i.e., towards east, south-east. Much has been done to check this advance by extensive planting of palmyras, but much more remains to be done. The *teris* are by no means barren sand heaps. Mixed with the silicious grains, is very frequently a percentage of fine red clayey matter large enough to make, in the presence of water, a very fairly productive soil.

16. *Depth of soil.*—The depth of soil is very largely a function of the steepness of the locality. On the steep hill slopes the soil is barely a foot deep, while on the scattered plateaux it is more than 15 feet to 20 feet deep as shown by road sections. All variations between these limits are to be met with. In the *teri*, the sand deposits vary from 8 feet to 35 feet and more.

17. *Drainage.*—The surface drainage is good in most of the area, where the rainfall is below 100 inches. In the reed areas where the rainfall goes up to 225 inches vast swamps are frequently to be met with. The drainage of the sub-soil however is extremely variable, especially on parts of the Mundanthorai plateau where, owing presumably to the presence of a clayey substratum near the surface, comparatively large areas become water-logged during the monsoons.

18. *Conclusion.*—The configuration of the ground, the composition and depth of soil and the degree of drainage are factors which have an undoubted effect on the distribution of species and on the quality of locality. The frequent and striking variation in the quality of the locality as reflected in the height growth, even in the same felling series, is thus easily accounted for.

SECTION 4.—CLIMATE.

19. *General.*—Being the most southerly division in India and therefore nearest the Equator, and shut off as it practically is on the west, by a high barrier of mountains, from the ameliorating influence of the south-west monsoon, the climate on the plains and on the lower foot hills up to an elevation of 1,000 feet to 1,500 feet is generally hot and dry. The appended table reproduced from the District Gazetteer gives a fair idea of the average maximum, minimum and mean shade temperatures prevalent at the division at head-quarters, Palamcottah. Since 1911 temperatures have not been officially recorded. The figures relate to the period 1893–1911 :—

Month.	Aevrage maximum tempera-ture.	Average minimum tempera-ture.	Average mean tempera-ture.	Remarks.
January	88·1	71·8	79·9	The highest tempera-ture recorded is 107·1 17th May 1906) and the lowest 64·9 re-gistered on three occasions in January and February.
February	92·6	72·8	82·7	
March	96·7	75·3	86·0	
April	98·5	78·3	88·4	
May	100·9	80·3	90·6	
June	96·9	79·4	88·1	
July	95·3	78·9	87·1	
August	96·5	78·6	87·5	
September	97·3	78·4	87·9	
October	93·7	76·3	85·0	
November	88·5	74·2	81·3	
December	86·2	72·2	79·2	

Since it would be of great interest to know the temperatures prevailing from time to time in the various Forest camps, the provision of cheap but efficient maximum and minimum thermometers in at least the more frequently visited forest bungalows is desirable.

20. *Temperatures.*—It will be seen that the maximum temperature is 94° ± 7° and the minimum temperature 76° ±4°. The average mean temperature is the highest for any district in the Presidency.. The hottest months are April and May. Early in June strong westerly and south-westerly gales set in with the break of the monsoon on the hills, and these moist winds perceptibly cool the air throughout the division. The maximum benefit from this moderating influence is obtained at places situated opposite the gaps in the hills, such as Kuttalam and its environs opposite the Ariankavu pass, Sivaisalem opposite to the Sivaiselam gap, and Tirukurangudi opposite the Nadugani gap. With increasing elevation also, the temperature falls rapidly and the hill camps of Sengalteri 3,150 feet and Mudaliaruthu 4,000 feet are delightful throughout the year.

21. *Rainfall.*—The appended table gives statistics of the average rainfall on the plains of the division for the more important recording stations. For purposes of comparison, figures are given for each of the four quarters, into which from a meteorological point of view, the year divides itself :—

Stations.	Years recorded.	January-Ma ch.	April-May.	June-September.	October-December.	Total,
Tenkasi	1870–1914	5·48	5·10	9·45	20·29	40·32
Kadaiyam	1906–1914	4·31	2·47	5·46	25·22	37·46
Sivagiri	1905–1914	4·75	3·86	4·54	23·35	36·50
Ambasamudram	1870–1914	5·87	3·62	3·14	22·42	35·05
Kadayanallur	1905–1914	3·87	2·44	4·70	21·38	32·39
Koilpatti	1902–1914	1·29	5·29	5·24	17·42	29·24
Nanguneri	1870–1914	4·15	3·14	3·10	18·67	29·06
Palamcottah	1870–1914	3·42	3·93	2·27	18·12	27·84
Sankarankoil	1870–1914	3·09	4·27	2 50	15·77	25·63
Srivaikuntam	1870–1914	2.83	2·87	2·05	17·44	25·19

It will be noted that normally two-thirds of the annual rainfall is recorded from October to December, and that the mean avearge for the division is in the vicinity of 30 inches.

The annual rainfall at the various forest recording stations for as long as reliable statistics are available is given in Appendix I. The table abstracted below shows the rainfall for a selected number of years in the 15-year period ending 1932. Abnormal years, and years for which only incomplete figures are available have been ignored. For convenience four monthly periods are taken as the rainfall from May-August may be reckoned as due to the south-west monsoon, that from September-December to the north-east monsoon, and the figures from January-April denote the rainfall for the interregnum between the two monsoons. Of course the value of such a classification is vitiated to some extent by the early or late appearance of the respective monsoons, the north-east monsoon being the principal offender in this respect, as it frequently breaks out only in December and overlaps into late January.

Rainfall.

Name of station.	Elevation in feet.	January-April.	May-August.	September-December.	Total.	Average years.
		Srivilliputtur Range.				
Athithondu	500′	9·25	6·38	29·51	45·14	10
Mudaharuthu	4,000′	12·85	8·34	32·27	53·46	13
Mudangiar	300′	11·76	5·10	23·98	40·84	11
		Kuttalam Range.				
Sengalmari	714	14·45	5·98	23·71	44·14	8
Kuttalam	750′	13·13	26·86	29·27	60·26	12
		Ambasamudram Range.				
Thirthakarai	850′	17·51	25·79	38·64	81·94	12
Kuduvarai	1,036′	19·22	36·76	40·93	96·91	12
Kuttalam	2,156′	20·16	48·04	43·07	111·27	12
Kalaruvi						
Mundanthorai	655′	18·01	14·41	31·93	64·35	11
Taravittanparai	746	11·46	13·64	26·54	51·63	8
Kannikatty	2,550′	20·97	51·55	46·33	118·85	11
Kalivelipil	4,040′	28·38	66·47	69·14	163·99	9
		Nanguneri Range.				
Sengalteri	3,151′	18·89	22·01	38·44	79·34	12
Nazareth	75′	6·60	3·50	18·62	28·72	8

22. *Inferences.*—The rainfall is thus a function of two determinants, varying with the elevation and the situation. It is the latter factor which determines principally the degree of rainfall received during the south-west monsoon. Thus Thirthakarai and Kuttalam situated in the Sivaisalem and Shencottah gaps respectively, receive a greater supply of rain than their elevation above mean sea level warrants. Again Taravittanparai which is higher than Mundanthorai and only about one and a half miles from it, receives less rainfall, as the high Kottaimalai ridge to the south-west of the former, shuts off much of the rain.

The rainfall figures for Kalivelipil 4,040 feet are so capricious as to raise serious doubts as to their reliability. They vary from 80·85 inches in 1918 to 378·84 inches in 1931. Situated as this station is, about 7 miles from Kannikatty in dense reed jungle haunted by elephants and infested by leeches, and therefore apt to be avoided by the forest subordinates who are usually timorous plainsmen, it is not believed that any useful purpose is served by its retention. The Taravittanparai gauge is also superfluous. In view of the importance of the teak plantations in the Kariar valley, where there is no gauge the Kalivelipil gauge could be shifted to this place with advantage. Nanguneri Range contains only one recording station. The Taravittanparai gauge could therefore be more usefully utilized at Sivanaperi, and two more gauges one mid way up the Kodamadi Ar valley, in Nanguneri Range, and the other at Nazareth in the Kudiraimozhi Teri Reserve, erected; vide paragraph 504 under miscellaneous prescriptions.

23. *The south-west monsoon.*—Only the Tambaraparni and its main affluents come really under the influence of the south-west monsoon, which usually breaks in the first week of June and continues to the end of August with irregular intervals of sometimes prolonged duration. The reason for this is that this river, and to a lesser extent its northern affluent the chittar, have their head waters rising well within the limit of the area, over which rain clouds rest continuously. The positions occupied by the clouds during this monsoon appear at first sight to be somewhat capricious, but they are doubtless in great measure due to air currents caused by the peculiar configuration of the mountains (referred to above) which mostly terminate eastward in very abrupt and precipitous scarps. This monsoon does not benefit the plains of the division to any appreciable extent, except by giving rise to the formation in some seasons of severe local thunderstorms which are sometimes accompanied by precipitation.

24. *The north-east monsoon.*—The north-east monsoon from October to December is not absolutely reliable in the division and if it fails, or as is more usual, if it is untimely, the most important dry crops under rainfed tanks cannot be raised and much distress ensues. Strangely enough, the failure of the monsoon in one season, is usually followed by excessive rains in the succeeding season, and consequent extensive and destructive floods, as owing to the flatness of the sea board nearly up to the foot of the ghats, the rivers and streams, all flow in wide shallow valleys. The most serious of such floods occurred in 1810, 1827, 1847, 1869, 1874, 1877 (two floods), 1880, 1895, 1914, 1923 and 1931. Enormous damage to irrigation works and roads is caused, and whole villages and large numbers of live stock are destroyed. The people however have learnt to expect

such visitations, and take precautions, so that loss of human life is comparatively insignificant. The greatest recorded flood occurred in December 1923 when the water rose to 31 feet at the Tinnevelly bridge.

25. *Conclusion.*—To recapitulate, the bulk of the rain is derived from the north-east monsoon from about the middle of October to the end of December. The south-west monsoon—June to August—only benefits the interior forests adjacent to the main water shed, and also the forests in the neighbourhood of the Shencottah, Sivaiselam and Nanguneri gaps. The forests in the Sankaranainarkoil and Srivilliputtur taluks do not benefit to an appreciable extent from this monsoon. The light irregular showers, are a very important factor and are preceded frequently by violent thunderstorms, which occur during the interregnum between the two monsoons. These showers perform a valuable function in decreasing the danger from fire and promoting the germination of seed, but are apt to interfere with burning operations in regeneration areas. The failure of these showers invariably hearlds a bad fire season, as the hot dry westerly gales which sweep the outer slopes of the ghats from June to September are a fruitful cause of disastrous fires.

26. *Health.*—With the exception of Kannikatty and its environs, the Kariar and lower Serviar valleys in Ambasamudram Range, the Alagarcoil valley in Srivilliputtur Range, and Sivanaperi in Nanguneri Range, all of which have a bad reputation for a particularly virulent type of malaria, the rest of the division is comparatively healthy. Kuttalam is believed to be feverish in the hot weather. The whole of the ghat forests of the division however, with the exception of the reserves noted below (which are class II special tracts) have been a class I special tract since 6th February 1933 :—

Number of maps.	*Name of Reserve.*
3	Kuttalam upper slopes.
52	Kuttalam, Kadayanallur and Krishnapuram upper slopes extension II.
48	Kottalam, Kadayanallur and Krishnapuram upper slopes extension III.
6	Kalakad Teak tract I.
76	Addition to Reserve No. 27.

The classification is amply justified inasmuch as, owing to the complete absence of hill villages, and the necessity for conveying camp equipment and all provisions by head loads, with labourers recruited from the plains, touring in the hills is both expensive and arduous.

SECTION 5.—WATER-SUPPLY.

27. *General.*—Mention has been made in paragraph 8 of the principal perennial streams; there are however a number of similar streams of lesser importance. The water-supply at the various camps in the division is generally sufficient throughout the year. The spring at Mudaliaruthu in Srivilliputtur Range, has been known to dry up occasionally during the hot weather, but the comparative unimportance of this camp does not justify expenditure on sinking a well. In camps where a suitable water-supply from natural sources is not available, wells have been dug. The stream which is adjacent to the Rest House and Ranger's Quarters at Sivanaperi is apt to cease flowing during the hot weather, and the pools thus caused in its bed provide a good breeding place for mosquitoes. Bags of saw dust soaked in kerosene oil were dumped in the principal pools annually, but this anti-malarial measure did not have much effect. The possibility of digging a channel in the stream bed so as to connect the principal pools in the vicinity of the buildings deserves investigation.

SECTION 6.—DISTRIBUTION AND AREA.

28. *Distribution.*—The fortsts of the division have a total extent of 404·68 square miles and are distributed over seven revenue taluks as shown below :—

Taluk.	Area of taluk in square miles.	Area of forest in square miles.	Percentage of forest area.
Tinnevelly district—			
Tiruchendur	323	17·77	5·50
Srivaikuntam	361	7·95	2·20
Nanguneri	693	87·45	12·62
Ambasamudram	490	139·34	28·44
Tenkasi	403	37·97	9·42
Sankarankoil	634	42·64	6·73
Ramnad district—			
Srivilliputtur	436	71·57	16·41
	3,340	404·69	**12·12**

The percentage of reserved forest area to the whole area of the district works out at 12·12 per cent for the Tinnevelly district.

29. *Area.*—The following statement shows the area of reserved forest in each range :—

Range.	Area in acres.
Srivilliputtur	45802·06
Kuttalam	51588·28
Ambasamudram	83211·94
Nanguneri	78395·39
Total ...	258997·67

SECTION 7.—BOUNDARIES.

30. *General.*—The external boundaries of the area under this working plan are partly natural (or requiring no special maintenance, as in the case of the common water shed boundary between the Tinnevelly district and Travancore State and the Ramnad district and the Gandamanaickenoor and Saptur zamindaries), and partly artificial requiring periodical clearing.

31. *Natural boundaries.*—The following are the natural external boundaries :—

(1) The common water shed boundary between Tinnevelly district and Travancore State running from Tiruvannamalai mottai in Nanguneri Range almost to Sivagiri Hill Peak in Kuttalam Range, with breaks where the Singampatti Zamin, the Shencottah enclave, and the Vairavankulam Zamin intrude between the reserved forests.

(2) The common water shed boundary between the Ramnad district and the Gandamanaickenoor and Saptur Zamins.

(3) The Tambaraparni river from its source up to Mundanthorai, which forms the common boundary between the Singampatti Zamin and the Papanasam Reserved Forest.

(4) The Rasinge Ar which is the common boundary between the Sivagiri forests and the Vasudevanallur Reserved Forest.

(5) The Periyar which is the common boundary between the Srivilliputtur Reserved Forest and Saptur Zamin.

32. *Artificial boundaries.*—Other external boundaries are artificial. They may be subdivided into "Political" and "Other reserve boundaries." Under "Political" come all the boundaries mentioned in paragraph 31 as well as the following :—

(1) The southern boundary of Kalakad Reserve from cairn No. 38 to the Travancore frontier watershed.

(2) The western boundary of Terku Viravanallur Reserve and the northern boundary of the Kalakad Reserve up to the Travancore frontier, which form jointly the southern boundary of the Singampatti Zamin. These two reserve boundaries are imperfectly demarcated by a few rock marks which besides being difficult to find are frequently duplicated along two different lines. The description of boundary in the settlement records is not clear, and varies both from the actual boundary on the ground and from the boundary as depicted in the 1 inch scale maps. There is not much exploitable forest along this boundary but it is essential, with a view to avoid future litigation to demarcate clearly, as early as possible, at least the portion of the line running from cairn No. I (at the junction of the vandal odai with the reserve forest boundary on the plains) to Panchantangi mottai, so that the working of the fuel coupes in the Vadagarai Felling Series during the period of the working plan may not be hindered by legal difficulties.

(3) The western boundary between the Aladiyur Reserve and Singampatti Zamin. This is badly overgrown, and should be cleared and kept clear, as the adjacent forests in the zamin are being worked by the zamindar and encroachments may occur.

(4) The portion of the common boundary between the Kuttalam Reserve and Travancore state forests running from cairn No. 182 to the water shed.

(5) The western boundary of Vadagaraimelpadagai reserve.

(6) The common boundary between Vellakalteri state forest and Chinnakadu Reserve.

(7) The common boundary between Kadayanallur Reserve Forest and Vairavankulam Zamin.

(8) The common boundary between Vairavankulam Zamin and Krishnapuram Reserve.

(9) The common boundary between Krishnapuram Reserve and Chokkampatti Zamin.

(10) The common boundary between the Srivilliputtur Reserve and the Settur Zamindari.

33. *The Travancore Tinnevelly frontier.*—This boundary was demarcated, presumably by the Survey of India, by cut lines and 2½ foot stone pillars or survey stone at salient points, the former being marked with conch marks on the Travancore side and arrow marks with reserved forest letters on the British Government side. Where pillars could not be sunk, the conch and arrow marks were carved on the surface of embedded rocks found on the line. The line is now overgrown, and its maintenance considering the fact that it is a water-shed boundary about 100 miles in extent at elevations from 3,000 to 5,000 feet and more is not a practical proposition.

In G.O. Mis. No. 1609, Revenue, dated 23rd August 1928, the Travancore Durbar gave their assent to the proposition that the clearance of the common boundary between the Presidency and the State, and the repair of boundary pillars on this boundary be carried out by officers of the Madras Government, half the cost of such work being debitable to state revenues provided that

(1) the estimates for the work contemplated were sent in advance to the Durbar so as to enable the latter to express its approval or otherwise,

(2) the date of commencement of the work was communicated to the Durbar sufficiently early so as to enable it to depute its officers to see the work in progress if necessary.

In G.O. Mis. No. 1795, Revenue, dated 7th August 1928, it was ordered that "all frontier boundaries between Indian States and the Presidency *marching along with reserved forest* should be inspected by the Forest Department once in three years." The expense and difficulty of carrying out such a work in this division, was brought to the notice of Government and the order was subsequently cancelled in B.P. No. 98, Press, dated 13th November 1929, communicating paragraph 3 of G.O. No. 1377, Revenue, dated 9th July 1919, and G.O. No. 2859, Revenue, dated 3rd August 1918. No clearing or inspection of this boundary by Forest Officers is therefore now necessary.

34. *Zamin boundaries.*—With the exception of the common boundary between the Aladiyur Reserve and the Singampatti Zamin, none of the other zamin boundaries inspected were demarcated by cut lines *and* stone pillars. In places where exploitation is going on or may take place in the future on either side of the common boundary between zamin or state forests and reserved forests, it is essential that the boundary be maintained adequately both with a view to avoid litigation and to prevent fires from crossing. The maintenance of such lengths of boundary lines as fire lines will accordingly be prescribed.

35. *Other reserve boundaries.*—The line of separation between the reserved forest and cultivation on the plains, is demarcated adequately by a 12-15 feet wide cleared line with stone pillars at each angle numbered serially for each block, with intermediate cairns where necessary. The clearing of these boundaries is a matter for the local beat subordinates, and the only defective clearing noticed was in the Sivaisalem and Kalakad beats. Where the boundary adjoins grass or woodland owned by pattadars, it is essential that the beat subordinates be compelled to keep a 20 foot line cleared of all growth in order to minimize the danger from fire as these patta lands are burnt annually by graziers, sometimes with the consent of the pattadar. The numbering of the cairns frequently does not coincide with the numbers marked on the 4 inches : 1 mile Survey of India sheets. The cheapest way to rectify this error would be to correct the latter.

36. *Encroachments.*—The only encroachment noticed was a small area of some 40 acres at the place in Kadayam beat, where the Ramanadhi river crosses the reserve boundary. The encroachment appears to be quite an old one but is not posted in the record copy of maps in the District Forest office. This should be done at an early date and the position regularized by the issue of a disreservation notice in the *Fort St. George Gazette.* The position of the encroachment has been roughly marked in the 4 inches scale map sheet No. 1 of Papanasam Reserve.

A number of encroachments have been recently discovered in the Kudiraimozhi Teri Reserve, the boundaries of which are in need of verification.

37. *Internal boundaries.*—The boundaries of the various coffee estates in the Kuttalam, Sivaisalem and Nanguneri hills are also imperfectly defined. Many of the old cairns have been demolished and the boundary in most cases is so overgrown as to be of little value. In view of the fact that most of the proprietors of these semi abandoned estates

work them mainly for forest produce such as charcoal and timber, it is of prime importance that the boundaries should be cleared, demarcated and maintained. The clearance is manifestly in the interests of the owner, and it is only just that he should maintain the boundaries. It is suggested that the grant of a property mark annually to a proprietor for the transport of forest produce from his estate, be made contingent on the adequate maintenance by him, of his estate boundaries.

The western boundary of the Kattalaimalai estate is now cleared annually, the estate authorities contributing half the cost. Its eastern boundary was intended to be the bed of the Kariar river but owing to the bed having shifted from time to time, areas on the left bank of the Kariar are now within the estate, and vice versa. It would contribute much towards reducing friction between the forest and estate authorities if this boundary were permanently demarcated.

SECTION 8.—LEGAL POSITION, RIGHTS AND CONCESSIONS.

38. *Ownership.*—All the reserved forests are the absolute property of the state and are not encumbered with any rights of importance. Such rights as have been admitted at the time of settlement consisting mainly of rights of way for men and cattle, are shown in the respective Section 16 notifications for each reserve, which have been recorded in the District Forest office in the reserve book.

The following statement gives the numbers and dates of the respective Section 16 notifications of all the reserves in the division arranged by ranges :—

Range and name of reserve.	Area in acres.	Number and date of section 16 notification.	
		Number.	Date.
Srivilliputtur range—			
Srivilliputtur Ghat forest upper slope ..	14,796·80	11	20th December 1883.
Unnipattimalai	550·40	230	30th July 1889.
Sappani Parambu, B. 18	381·87	311	24th October 1889.
Srivilliputtur Ghat forests lower slope ..	28,136·19	175	21st April 1891.
Valaikulam Parambu	1,145·60	335	23rd July 1891.
Khansapuram	535·83	383	22nd August 1899.
S. No. 1869 to 1871 of Valaikulam	7·51	234	8th May 1908.
S. No. 1725 of Valaikulam	0·23	195	4th May 1909.
Sappani Parambu extension	5·97	135	2nd March 1911.
Addition in Valaikulam S. No. 1861 and Kollankondan S. No. 2359	27·45	25	23rd December 1911.
Pillayarnatham extension V.	12·71	108	22nd February 1912.
Valaikulam Parambu extension	34·33	266	4th June 1912.
V (a) Sundarapandiam	34·52	265	Do.
Addition to Pudupatti	49·16	267	Do.
Extension to Venkateswarapuram	34·54	303	17th June 1912.
Addition to Lakshmipuram	35·60	151	19th March 1913.
Do. Valaikulam	5·53	492	9th October 1913.
Do. Alagapuri	0·34	507	31st October 1913.
Do. Khansapuram	5·69	74	27th January 1914.
S. No. 1570 Valaikulam	1·76	490	9th November 1917.
Total ..	45,802·06		
Kuttalam range—			
Kuttalam reserve forest upper slopes ..	7,350·77	11	20th November 1833.
Kadayanallur upper slopes	5,036·80	11	20th December 1883.
Krishhapuram upper slopes	3,654·40	11	Do.
Puliangudi Chintamani, Vasudevanallur upper slopes	16,038·40	11	Do.
Chinnakadu reserve forest	1,388·80	248	9th June 1890.
Vadagarai Kilpadagai 3 (c)	582·40	178	10th April 1891.
Kadayanallur upper slopes 3 C (2) lower slopes	1,171·20	178	Do.
Vadagarai Melpadagai 3 (b)	432·20	178	Do.
Extension I Kuttalam No. 3 and lower slopes	1,698·00	178 and 179	10th April 1891 and 16th March 1901.
Krishnapuram upper slopes extension ..	1,946·50	178 and 156	10th April 1891 and 14th March 1901.
Puliangudi, Chintamani-Vasudevanallur lower slopes	10,496·00	176	10th April 1891.
Alakondal, Nelliyuthu, Sermalai	163·04	281	7th June 1898.
Chintamani Block 'A' and 'B'	321·46	231	19th May 1899.
Extension III Kuttalam, No. 3 lower slopes.	144·50	231	7th June 1898.
Do. II do. ..	133·00	205	21st May 1902.
Vasudeva Estate	162·00	165	22nd March 1910.
Panjantangi Estate	72·80	535	25th November 1911.
Chinnakadu reserve forest addition	0·90	28	15th December 1911.
Naranapuram reserve forest	390·31	193	29th March 1911.
Kadayanallur addition and small bits (9) ..	33·12	53	18th January 1912.
Vadagarai Melpadagai North 'A' South 'A' and 'C'	70·96	438	27th September 1912.
Krishnapuram upper slopes addition ..	12·42	473	29th October 1912.

Range and name of reserve.	Area in acres.	Number and date of section 16 notification. Number.	Date.
Kuttalam range—*cont.*			
Addition to Vasudevanallur	18·29	414	19th September 1912.
Do. Melpuliyangudi	8·83	411	Do.
Do. Melchintamani	6·21	439	3rd October 1912.
Do. Naranapuram	7·07	440	Do.
Do. Thirumalaipuram	2·23	437	Do.
Old S. No. 1357, east of Ilanchi	31·51	49	17th January 1913.
Addition to Kuttalam reserved forest, Tri-kulachalaparvatham estate	26·66	470	6th October 1915.
Hope estate	183·50	17	9th October 1920.
Total ..	51,588·28		
Ambasamudram range—			
Papanasam Ghat forest, upper slopes ..	63,838·85	11	20th December 1883.
Do. lower slopes	19,172·66	534	27th October 1890.
Hill enclosing upper and lower slopes ..	189·44	19	20th December 1911.
Kaloli enclosure	8·78	81	31st January 1912.
Slopes Vikramasingapuram, village	2·21	581	28th November 1913.
Total ..	83,211·94		
Nanguneri range—			
Kalakad Tirukurangudi Ghat forests, upper slopes	33,508·39	11	20th December 1883.
Kalakad Teak tracts, I to III..	271·20	165	10th June 1889.
Kalakad Tirukurangudi Ghat forests lower slopes	21,083·20	533	27th November 1890.
Kolandamamalai reserved forest	1539·17	88	17th February 1890.
Terku Veeravanallur reserved forest ..	3,187·20	534	27th November 1890.
Vallanad hill block 'A', & 'B'	4,647·20	465	14th October 1891.
Kudiraimozhi Teri reserved forest	11,371·77	309	21st June 1892.
Lands to block 'A' I to III	428·28	390	3rd August 1896.
Manpothai reserved forest	1,242·00	511	8th November 1898.
Vanamutti..	1·99	194	25th April 1898.
Mahendragiri	33·78	249	18th May 1898.
Nadugani bit I	3·84	487	12th December 1903.
Valliyur reserved forest..	605·11	51	28th January 1904.
Nadugani bit II	6.46	244	14th June 1905.
Kulisalkidai	0·99	244	Do.
Jadikai Tottam	2·55	244	Do.
Ladan Tottam	10·22	247	20th July 1906.
Taraganar estate..	110·00	243	10th May 1907.
Valliyur reserved forest extension	112·50	478	6th November 1908.
Mayaparambu estate	109·20	497	5th September 1910.
Vallanad addition	11·90	16	24th December 1910.
Addition to map No. 20, S. Nos. 483 and 484, Malayadipudur..	6·50	147	11th March 1912.
Addition to map No. I, Nadugani last bit, S. No. 982 of Tirukurangudi village ..	1·32	349	14th July 1913.
Addition to map No. I, Mahendragiri, S. No. 984/2	9·88	163	12th July 1921.
Addition to Karumandiamman, S. No. 803 shola	90·74	110	21st April 1923.
Total ..	78,395·39		

The numbers and dates of Section 16. Notification pertaining to the reserves in the division handed over to panchayats or to the Public Works Department for managements are set out below :—

Range and name of reserve.	Area in acres.	Number and date of section 16 notification. Number.	Date.
Public Works Department, Tuticorin Port Trust—			
Kalivayur reserved forest	158·07	197	6th February 1889.
Mullakadu reserved forest	949·26	297	3rd November 1923.
Hare Island reserved forest	146·12		
Pannaiyadi Island reserved forest ..	105·59		
Panchayat—			
Gangai kondan reserved forest	13,91·00	363	2nd August 1898.
Sivalaperi reserved forest	213·14	149	10th April 1891.
Melapattam reserved forest	1,000·00	588	3rd December 1897.
Wolf Hill reserved forest..	848·13	474	11th September 1896.
Talaiyuthur Block A & B	493·74	368	24th July 1896.
Do. reserved forest	890·81	150	10th April 1891.
Kottamalai reserved forest	883·20	304	24th October 1889.
Kavalkattiparambu reserved forest	371·20	303	Do.
Kottamalai addition	19·27	18	21st December 1911.
Do. extension	137.61	529	21st November 1912.
Kottamkulam Block 17	550·40	214	27th May 1890.
Total ..	8,157·54		

39. *The Gandamanaickenoor path.*—This path in Srivilliputtur Range threatens to be a source of danger to the efficient protection of the forests on either side of it from fire. At the time of settlement it was admitted as a right of way for men and cattle. It is now used by a contractor of the Gandamanaickenoor zamindari for the transport of scantlings of evergreen species from the sholas in this zamin. This by itself is not objectionable, but the contractor also gets an average revenue of some Rs. 12,000 per annum by issuing grazing permits for cattle in the zamin forests which have been leased out to him. These cattle go up this path which climbs 4,000 feet in 4 miles in batches of 100 to 200 at a time. As the path is steep the cattle have to be rested en route in the reserved forest and this has resulted in the annual firing of suitable halting places so that the cattle may be fed gratis en route. The fires have naturally spread up hill and eaten into the edges of the adjacent Tirunatteri shola. It is essential from the point of view of safeguarding the irrigation on the plains that shola forest should be induced to cover these steep slopes and this will be done in the course of time in the absence of fires. Although the contractor's right to convey timber along this route has been tacitly admitted by the registration of his property mark annually for the last decade, it is not a route recognized by the Timber Transit Rules prevalent in the division. It is suggested therefore that the contractor's property mark be registered in future, only on condition that he enters into an agreement that he will be responsible on pain of forfeiting a security deposit, of say Rs. 100, for all fires which have occurred in the vicinity of the path. This arrangement is quite equitable as there is no possibility of any cattle or men authorized by the forest department, using this path above the cairn's line.

40. *Tree pattas.*—A peculiar survival is the existence of tree pattas, issued in pre-settlement days to pattadars, for the usufruct of palmyras and fruit bearing trees growing in the reserves. The table below shows the extent of such rights, the assessment therefor being collected by the revenue authorities and credited to the Forest department. These rights are being gradually extinguished by the death of the patta trees.

Name of reserved forest and authority.	Taluk and village.	Palmyras.				Other trees.					
		Paruvam.		Kattu.		Olaivettu.		Mango.		Tamarind.	
		No.	Tax. RS. A. P.	No.	Tax. RS. A. P.	No.	Tax. RS. A. P.	No.	Tax. RS. A. P.	No.	Tax. RS. A. P.
Kudiraimoli Teri reserved forest— G. O. No. 636, Revenue, dated 21st July 1892 B. P. For No 390, dated 21st June 1892.	Tiruchendur—										
	1 Kachanvilai.	1994	124 10 0	1969	61 8 6	..	..	19	4 12 0	..	..
	2 Nalumavadi.	1565	97 13 0	1531	47 13 6	..	..	..	..	..	..
	3 Kanam.	2397	148 11 0	2440	76 4 0	..	..	..	..	..	..
Kalakad reserved forest— G.O. F. No. 294, dated 27th November 1890.	Nanguneri—										
	1 Kovilammal puram.	49	3 1 0	70	2 3 0	340	8 6 0	..	..	..	..
	2 Idayankulam.	92	5 12 0	290	9 1 6	..	..	..	..	..	..
	3 Malayadipudur.	204	12 12 0	237	7 5 6	149	2 5 3	..	..	23	5 12 0

CHAPTER II.—DESCRIPTION OF FOREST.

SECTION 1—COMPOSITION AND CONDITION OF CROP.

41. *General.*—Elevation, rainfall, the nature of the soil, and proximity to cultivation and therefore to injury by man, are the principal factors which control the types of forest growth in the division. For convenience of description the main types enumerated below may be distinguished. The line of distinction between two types is by no means clear, one type tending to merge almost imperceptibly into another. The area data given under each type should, therefore, be considered only as a rough approximation, as both the value of the standing growth and the precipitous nature of most of the country did not justify expenditure on very detailed stock mapping into types.

42. *Type I* consists of an extremely xerophytic type of vegetation, the principal species being *Dalbergia multiflora, Acacia planifrons, Acacia latronum, Zizyphus xylopyra, Albizzia amara* and *leucophlœa, Balsamodendron berryi;* and *Dichrostachys cinerea;* the undergrowth consists mainly of *Dodonea viscosa, Pavetta indica, Cassia auriculata, Plectronia parviflora* and *Euphorbia tirucalli* with strobilanthes in the moister parts. Examples of the forests of this type are the plain forests of Vallanad in Srivaikuntam taluk, the Valaikulam and Sappaniparambu reserves in Srivilliputtur taluk and the Kolundamamalai and Manpothai reserves in Ambasamudram taluk. Being closest to cultivation, this class of forest suffers most from overgrazing and injuries by man. The surface soil being hard and of low permeability, what little rainfall there is runs off the surface of the hilly ground rapidly with the result that although coppice regeneration is fair, natural seedling regeneration is conspicuous by its absence. The result is that stocking is variable, being very poor in parts. Some form of artificial regeneration,

whereby the rapid descent of rain water may be arrested, and the moisture made available for the seedlings raised, is clearly called for, in order to enable the complete stocking of these forests. Money spent on such measures would, we consider, be amply recouped from the increased yield, in view of the proximity of such reserves to consuming centres and their consequent accessibility. The present average money yield of fuel series in this type of forest is 6 to 8 annas per acre per annum.

Area : 11,570 acres.

43. *Type II* is a less xerophytic type which extends for the most part over the outermost slopes of the ghats, from the margin of cultivation to an elevation of 300–500′. Here the principal species are teak, *Albizzia amara, Zizyphus sp., Givotia rotteriformis, Cochlospermum gossypum, Protium caudatum, Acacia leucophlœa, Dolichandrone crispa, Morinda tinctoria, Butea frondosa,* etc., the undergrowth consisting mainly of *Dodonea viscosa, Ixora parviflora, Pletronia parviflora, Carissa carandas, Cassia auriculata* and *Maba buxifolia*. This type is probably only a progressive succession on type I and a regressive succession of type III described below caused principally by destructive fires and excessive grazing in the past. Area : 38,080 acres.

44. *Type III* may be described as an associate formation of deciduous species degraded in parts by recurrent fires. It comprises all the forests on the outer slopes above type II up to an elevation of about 1,700′. In favourable localities where the soil is richer, e.g., the Ayyanarkoil series—or the rainfall greater—e.g., the Kuttalam series west of the Chittar—this type comes down to the margin of cultivation. The principal species associated with this class of forest are teak *Petrocarpus marsupium, Dalbergia sissoides, Albizzia lebbek, Albizzia odorotissima, Grewia sp., Chloroxylon swietenia, Terminalia belerica, Schleichera trijuga, Stereospermum chelonoides, Pongamia glabra* (along streams), *Anogeissus latifolia, Sapindus emarginatus, Melia dubia, Melia azadirachta, Careya arborea, Dalbergia paniculata, Eugenia jambolana, Bridelia retusa, Hardwickia binata,* etc. The undergrowth consists principally of *strobilanthes*, grasses, *Helicteres isora, Pavetta indica, Mundulea suberosa, Murraya exotica, Glycosmis pentaphylla,* etc. Creepers are of very frequent occurrence, the principal being *Acacia intsia, Pterolobium indicum* and *Atylosia sp.* Where fires are rare and the rainfall over 50″ the growth is dense, and the species in admixture good. The locally famous slow grown teak of the division is found in this type of forest, the best growth being found between 500′ and 1,000′ elevation. The only sandal in the division, in the Alagarcoil valley of Srivilliputtur range and to a smaller extent in the Kuttalam fuel series, occurs in this type of forest. Practically all the fuel series are to be found in these two types of forest. Whereas coppice regeneration is generally good, seedling regeneration leaves much room for improvement. There is a distinct need for artificial regeneration not only to accentuate the density of stocking where necessary but also to increase the number of the more desirable and valuable species, such as teak, *Dalbergia latifolia* and *sissoides* and *Pterocarpus marsupium* where these species can be grown satisfactorily. The present average money yield of type II forest, as exemplified by the Ambur Felling Series, is 7 annas per acre per annum; while that of the type III forest varies from Rs. 2 to Rs. 2–8–0 per acre per annum, the Kalakad and Kuttalam Felling Series respectively being taken as limiting examples. This forest type is eminently suited for the production of small timber if worked under " simple coppice " on a rotation of 35–40 years. Rigid fire protection and closure to grazing for at least the first decade of the rotation are the two essentials. Area : 31,740 acres.

45. *Type IV* where fires are recurrent especially on steep slopes, a Savannah formation appears. Here the canopy is very open, high grass (*Andropogon bladii* principally) overruns the area, and only fire resistant species like *Anogeissus latifolia, Terminalia chebula, Pterocarpus marsupium, Buchanania latifolia, Careya arborea, Phyllanthus emblica* remain scattered over the grass in a damaged condition. The area below the Sengalteri Rest-house is a characteristic example. This class of forest is not suitable for exploitation at present but with adequate fire protection would probably revert to type III in process of time. It comprises many of the so-called " Hill grazing " compartments of the division and will be regarded as having for the present only a protective function. Area 53,040 acres.

46. *Type V* where the rainfall is over 75″ and elevation over 1,000′ and the soil suitable the deciduous forest gives way to a semi-evergreen type the principal species met with being *Balanocarpus utilis, Hopea parviflora, Pterospermum rubiginosum* and *glabrescens, Aglaia courtallensis and barberii, Nephelium longanum, Hemicyclia venusta, Hardwickia pinnata, Stereospermum chelenoides, Dalbergia latifolia, Chukrassia tabularis, Artocarpus integrifolia, Bischofia javanica, Carallia integerrima, Diospyros sp.,* together with a host of others less known species. The undergrowth here consists of strobilanthes. *Glycosmis pentaphylla, Heleteres isora,* canes, etc. Small patches of this type of forest are found along streams at elevations below a 1,000′ but the greater portion occurs between 1,000′ and 2,000′ elevation. Where the soil, as reflected in the height growth, is good,

this type of forest is ideally suited for conversion into teak plantations. The majority of this type shows a marked uniformity as far as the density of stocking is concerned, which is quite good. This is probably accounted for by the increased rainfall and consequent increased vegetative activity. The quality of locality however varies greatly with the depth of soil, and as a few years are necessary for the factors of locality to manifest themselves in the young crop, an unwise selection of an area for teak planting is apt to become apparent only after four to five years, when it is too late to remedy the defect. Parts of the Kodamadi and Kariar teak plantations exemplify this. The height growth of the existing forest is the only safe criterion to go by in selecting areas suitable for teak planting. Area : 14,700 acres.

47. *Type VI* is the evergreen rain forest or shola forest. This is the most highly developed ecological type of vegetation in the division. The great mass of this class of forest commences at an elevation of about 2,000′ and extends upwards to nearly the crest of the mountains up to 4,500′, the growth deteriorating rapidly along the windswept ridges, both in quality and volume per acre. The whole of the hills above 2,000′ are not however clothed with shola forest. There is much bare and precipitous rock and extensive areas where the rock is near the surface are covered with high grass, *Phœnix sylvestris*, and stunted tree growth. Small patches of isolated shola, cap most of the sheltered faces of the peaks and thus enhance their scenic value. Much of the true shola forest has been destroyed by extensive clearings made by hill tribes—the Kanis—and coffee planters in the past. The secondary shola growth, consisting chiefly of *Macaranga, Mangifera, Clerodendron, Dyospyros sp., Eugenia sp., Myristica sp.*, etc., which is met with in abandoned coffee estates and old Kani clearings, are a feature of the tract, characterstic examples of the former being the old Kuliratti and Taraganar estates in the Nanguneri hills, and of the latter the Sembatota on the left bank of the Kariar. Area : 44,100 acres.

With decreasing rainfall the minimum elevation at which the true shola appears increases. Thus in Nanguneri Range where the rainfall is less than in the Ambasamudram Range, the shola forest starts at about 3,000′ elevation and is at its best at 3,500′ to 4,000′, deteriorating higher up. Similarly in the Srivilliputtur Range where the rainfall is even below that obtaining in the Nanguneri sholas, the true shola appears only at about 3,500′ and rapidly deteriorates above 4,000′.

The characteristic shola type of forest occurs principally in Ambasamudram Range, where it forms a three-storeyed high forest. In the topmost canopy occur principally *Mesua ferrea, Cullenia excelsa, Gluta travancorica, Pallaquim ellipticum, Hopea parviflora, Heritiera papilio, Dysoxylum malabaricum* and *beddomei, Myristica beddomei, Eugenia sp., Elæodendron glaucum, Elæocarpus tuberculatus, Canarium strictum* and *Vateria indica.* In the second storey, besides pole growth of the species enumerated above occur *Aglaia species, Myristica malabarica, Artocarpus integrifolia, Anacolosa densiflora, Gordonia obtusa, Nephelium longanum, Pæciloneuron pauciflorum, Lansium sp., Litsaea sp., Pygeum wightianum, Filicium decipiens, Garcinia sp.*, etc. In the lowest tier, besides sapling growth of the species mentioned above, is found *Agrostistachys longifolia, Mallotus sp., Cinnamomum gracile, Aporosa acuminata, Hydnocarpus alpina* and the bright crimson fruited *Baccaurea courtallensis.* The undergrowth consists principally of rattan, wild cardamoms, *Pandanus sp., Solanum sp.*, and the dreaded, but comparatively rare devils nettle, *Laportea crenulata.* Picturesque ferns and palms, *Pinanga dicksonii* and *Caryota urens* are also scattered all over the forest. Area : 24,600 acres.

The Nanguneri sholas are characterized by the total absence of *Gluta travancorica*, the comparative rareness of *Mesua ferrea* and the great preponderance of *Pallaquium ellipticum* and *Mangifera indica.* The dominant association in the Sengalteri shola is the *Pallaquium-Mangifera type.* Around Netterrikkal a few big sized *Podacarpus latifolia* occur, but beyond the botanical interest centred in the fact that it is the only indigenous conifer in South India, the tree is not of importance as it is not present in exploitable quantities. The Nadugani and Mahendragiri sholas are also of poor quality, the principal saleable species being *Bischofia javanica* and *Heritiera papilio* of comparatively small dimensions. Area : 9,100 acres.

The Kuttalam sholas are all very deficient in exploitable species, and are generally poor, all the best shola areas having been acquired by coffee planters in the past and partially destroyed. Area : 6,700 acres.

The Srivilliputtur Range contains a number of patches of shola varying in size from 100 acres to 350 acres, which are surrounded by grass land. The sholas are not either so dense or so luxuriant as in the Ambasamudram Range and, owing to the fact that the Travancore high ranges and the upper Palnis keep off much of the rain which would otherwise fall on these hills, the locality is far less moist. The principal species are

Acrocarpus fraxinifolius, Cedrela toona, Mesua ferrea, Eugenia sp., Pallaquium ellipticum, Bischofia javanica and *Mangifera indica.* The maintenance of the essential character of these rain forests, whether exploitable or not, and the undertaking of inexpensive measures for their extension are matters of the first importance, in view of the great part they undoubtedly play in conserving and regulating the water-supply of the rich and extensive irrigated lands in the plains, some of which, in the Tambaraparni valley, bear a double crop assessment of Rs. 22–8–0 per acre per annum, a rate unknown elsewhere in the Presidency. Area : 1,350 acres.

48. *Type VII* embraces the areas covered by the eta reed. Near the summit of the hills above the belt of shola forests and along the higher slopes of the various mountain ranges, 3,000′ and above, extensive areas are covered with eta reed, *Ochlandra brandisii* and *Ochlandra travancorica,* an erect reed like gregarious bamboo " forming impenetrable thickets of 10′ to 15′ high from which stand out scattered trees of *Vernonia monosis* and *Eugenia sp.* " (Brandis). This reed not only occurs in vast areas, to the exclusion of all other vegetation, but also encroaches into sholas wherever the fall of a big tree on the borders of a shola lets in sufficient light to permit of its growth. Streams also play a great part in dissemination of the seed of the reed, many of the streams originating in reed areas, and flowing through sholas containing a dense growth of reeds on their banks wherever light conditions are suitable. A picturesque feature of the reed areas is the gregarious growth of the palm *Bentinckia coddapana,* which usually cultivates the steepest portions of rocky peaks and knolls above 4,000′ elevation, and contributes much towards alleviating the monotony of the vast sea of eta. That the reed encroaches on the shola and not vice versa is, we consider, borne out by the frequently observed fact that large trees of *Pallaquium ellipticum, Mesua ferrea,* etc., are frequently noticed growing *isolated* in a sea of reed jungle. This class of forest has not been exploited in the past to any appreciable extent but has great economic possibilities which are commented on in paragraph 82 below. One rather remarkable feature is that whereas the eta reed occurs widespread in Kuttalam, Ambasamudram and Nanguneri Ranges it is conspicuous by its absence at similar elevations in Srivilliputtur Range. The lower rainfall may account for this. Area : 35,100 acres.

49. *Height growth.*—The height growth is a function chiefly of three variants the species, the factors of locality, and the rainfall. In type I forest which is mainly scrub jungle the height growth at maturity rarely attains 12 to 15 feet, the average being in the vicinity of 10′. Type II varies from 12 to 25′, and type III which comprises the best deciduous forest, from 25 to 50′. In type IV the height growth on account of adverse factors like fires, and the diminishing fertility of the soil, recedes to 20 to 25′, the average being well below 20′. The semi-evergreen type maintains a height of 35 to 60 feet, merging almost imperceptibly into the evergreen shola forest. The height growth of the latter varies with the rainfall and the depth of soil which tend to increase it, and the elevation which tends to depress it. Thus on the windspent ridges above 4,000′ the forest is barely 30 to 40′ high, while in the undulating valleys at 2,500 to 3,000′ elevation of which the forest at Kannikatti is typical, the forest has an average height of 120 feet.

50. *Density of stocking.*—In most of the fuel felling series this is probably between 0·7 and 0·8 on an average, though it is so variable that in the same coupe a fully stocked area and an area where the stocking is below 0·5 is often met with. Type IV forests, however, are the most sparsely stocked, the density of stocking being well below 0·2 as a rule. The semi-evergreen and evergreen forests are fully stocked, the blanks met with being obviously areas where either nature has given up the attempt at afforestation as an impossibility, or areas which have been destroyed by man in the past and are under process of being reclaimed to forest growth.

51. *Teak plantations.*—Mention must be made of the existence of some 260 acres of teak plantations formed in the past by enthusiastic District Forest Officers with a view to testing the suitability of semi-evergreen forest for teak. The oldest plantation made in 1907 has already more than paid for itself from thinnings; given the necessary soil conditions, such conversion is a most profitable forest investment. Another encouraging factor is that the existing growth is saleable and fetches as much as Rs. 20 to Rs. 50 per acre.

In the choice of areas for teak planting the nature of the soil is an important factor. A simple rule is not to choose areas where there is too much red in the soil. The highly ferruginous nature of such soils has been found by experience in this division, to have a definitely deleterious effect on the subsequent growth of the teak. Pale red soil, river alluvium, and the light brown soils found in semi-evergreen areas have been found to be most suitable. This rule also applies to the introduction of teak in regeneration operations in the fuel series.

52. *Seed years*—Most of the deciduous fuel species seed fairly abundantly annually. It is a matter of local experience that a year of bad rainfall is *followed* by a particularly good seed year. The evergreen species, however, are somewhat capricious in this respect

and good seed years occur at intervals varying from two to four years. Such information as is considered reliable regarding the time of flowerng, seeding, etc., of our more important fuel and timber species has been collected and is detailed in Appendix II. It has been found that Range Officers' annual reports on this important subject have tended to be more or less faithful copies of their predecessors' reports, and are therefore liable to the suspicion of inaccuracy.

SECTION 2.—INJURIES TO WHICH THE CROP IS SUBJECT.

53. *Climate.*—The chief climatic factor to be feared from the standpoint of regeneration is the failure, partial or total, of the monsoons. Untimely rainfall also affects regeneration operations. The south-west monsoon breaks usually early in June, but heavy and continuous rainfall is not unknown in May. Time is the essence of all regeneration operations, and expenditure on replacing casualties, can only be kept within reasonable bounds, if such operations are conducted so as to take immediate advantage of such rain that occurs. It is therefore important that all is ready for teak planting by the end of April at the latest. The frequent and sometimes prolonged breaks in this monsoon point to the advisability of " stump planting " of teak rather than dibbling or transplanting, as the reserves of food material stored in the " stump ", and the depth of planting which enables it more quickly to tap the lower soil moisture, will aid the plant in tiding over rainless periods of short duration. In addition to these factors the size of the stump will enable it to withstand displacement by floods to a greater extent, a matter of great importance in localities where a rainfall of over 16″ in 24 hours is not unknown; such was experienced during the north-east monsoon of 1931 at St. Mary's, Kattalaimalai estate. Another influence of early rainfall even if light, is to hinder the proper burning of debris in regeneration areas. The so called *Kodai* rains of April, which are of immense help in assisting the agriculturist to get a " golden " tilth for ploughing, frequently obstruct burning operations, and the necessity for completing burning in all regeneration areas by the end of March is indicated. The north-east monsoon is also capricious appearing at any time from the middle of October to the first week of December. Its late appearance usually heralds a season of floods. All preparations for regeneration operations in the fuel series which come under the influence of this monsoon only, are best completed by the end of September.

54. *Winds.*—The hot dry gales which sweep the eastern face of the ghats from June to September generally from the west (although owing to the formation of the mountain masses the wind direction is apt to vary from south-west to north-west) do some damage especially to standards in the " Coppice with Standards " coupes, and to young regeneration areas, where the teak plants are frequently broken, blown down or deprived of their leaves. The necessity for carrying out fellings, as far as possible against the wind direction is indicated. The impetus these winds give to forest fires is however a greater menace to the forest.

55. *Fire.*—The maxim that " fire is a good servant but a bad master " is seldom impressed on humanity with greater force than it is on the forest officer. The fire season in the division extends for seven months from April to October, fires being especially frequent and disastrous in those portions of the division which do not come under the beneficent influence of the south-west monsoon. The maximum intensity is attained in such areas from May to September. The following table abstracted from the fire reports of the division shows the average monthly incidence of fires during the decennium 1922–1931.

Name of range.	Srivilliputtur.		Kuttalam.		Ambasamudram.		Nanguneri.		Total.	
Area in acres.	45,802·06		51,588·28		83,211·94		78,395·39			
Month.	Number.	Area in acres.	Number.	Area in acres.	Number.	Area in acres.	Number.	Area in acres.	Number.	Area in acres.
January ..	..	..	..	..	..	..	0·2	19·0	0·2	19.0
February ..	0·3	26·8	1·0	33·4	0·2	72·5	0·3	3·9	1·8	136·6
March	0·6	39·1	2·4	55·3	0·1	4·5	0·8	61·2	3·9	160·1
April	0·4	7·5	2·7	154·0	0·2	13·0	1·1	48·6	4·4	223·1
May	0·2	1·7	10·4	1,445.0	5·2	1,635·0	3·5	599·1	19·3	3,680·8
June	2·1	147·1	4·5	314·1	4 0	352 2	2·7	813·8	13·3	1,627·2
July	3·5	473·8	3·2	318·5	1·7	121·6	1·2	179·3	9·6	1,093·2
August	3·2	215·1	3·1	200·3	1·9	149·6	1·9	275·6	10·1	840·6
September ..	1·0	76·8	2·4	48·1	1·9	199·3	2·3	208·0	7·6	532·2
October	0·3	25·8	0·7	12·8	1·0	29·0	1·0	63·8	3·0	131·4
November ..	..	..	..	..	..	..	..	..	..	..
December ..	..	..	0·2	21·7	..	..	..	..	0·2	21·7
Total ..	11·6	1,013·7	30·6	2,603·2	16·2	2,576·7	15·0	2,272·3	73·4	8,465·9

N.B.—The figures under number of fires and area burnt have been obtained by dividing the total number of fires and the total area burnt respectively, during the decennium, by ten. The figures for the old Srivaikuntam Range have been ignored as both the number of fires and their extent are too insignificant to be considered.

56. *Incidence of fires.*—The low percentage of the average area burnt annually to the total area of the forest, namely, 2·21 per cent in Srivilliputtur Range, 5·04 per cent in Kuttalam Range, 3·14 per cent in Ambasamudram Range and 2·89 per cent in Nanguneri Range, which these statistics disclose, does not mean that the fire problem is not acute. The reprehensible tendency on the part of the forest subordinates to minimize greatly the reported area burnt in their own interests is largely responsible. The abstract is however of interest, in that it shows more or less accurately the average monthly incidence of fires.

57. *Causes of fires.*—Fires in the division are principally caused by graziers in search of tender grass for their cattle. This nefarious pastime of the ryot is more commonly practised in the various zamin and mittah forests of the division, where discipline is lax and retribution slow or absent, and where on account of the constant fires much of the original forest has been converted into poor grass land. The Chokkampatti and Vairavankulam mittahs in Kuttalam Range are characteristic examples, and a comparison of their present state with the state of the adjacent Government forests will convince even the most sceptical layman of the advantages of forest conservation, so striking is the difference. The need for safeguarding the forests of the division by fire tracing the common boundaries between the reserves and zamin forests is very pressing in view of the fact, borne out amply by fire maps of recent years, that the majority of fires have crossed over the common boundary from zamin forests. The zamindars are, or pretend to be, quite alive to the danger of fires and most of them have expressed their willingness to contribute labour or money towards clearing and fire tracing their common boundary. Advantage should be taken of this, to put the matter, by agreement, on a permanent basis. The solution of the fire protection problem as far as the reserves are concerned, lies in the *immediate* closure to grazing, of all areas burnt, on silvicultural grounds, to enable them to recover. Experience has shown that this is of value provided a consistent policy is followed. Closure, however, must be effective otherwise grazing fees merely find their way to the pockets of the subordinate staff instead of into the treasury. Frequent inspections of closed areas by the District Forest Officer and remorseless treatment of delinquent subordinates is what is needed. The necessity for putting out fires as soon as they are detected does not appear to have been sufficiently impressed on the subordinate staff, many of whom are not even aware of the provisions of section 23 of the Madras Forest Act, whereby the nearest villagers, contractors, labourers, etc., can be impressed by forest subordinates, on pain of penalties, to help in extinguishing fires. The present system under which forest subordinates are allowed on occasion to pay coolies for help in extinguishing fires cannot be sufficiently condemned. It is open to the serious abuse, that ryots in the off agricultural season may frequently set fire to the forests themselves, in the expectation that they may be paid by the department to extinguish such fires. A few judicious prosecutions would certainly bring round recalcitrant villagers to a sense of their responsibilities relating to fire fighting.

Apart from this source fires are also caused by the minor forest produce contractors' coolies, while searching for honey, gallnuts, etc., and a few fires escape from the charcoal pits of fuel contractors, mainly through carelessness. The ancient muzzle loading guns of illicit poachers, packed as the barrels are with gunpowder and paper wads also cause fires, especially as this class of ryot frequently haunts the forest during the nights of the fire season, when the weather is likely to be less inclement and scarcity of water concentrates game at well-known water holes.

58. *Fire damage.*—The chief injuries to the forest from fire are :—

The invasion of coarse grass to the exclusion of more desirable grasses and undergrowth, the killing back of valuable regeneration as well as of older trees, the scarring of trees, the scorching of foliage and consequent loss of increment, and the impoverishment of the soil through the removal of desirable humus and its sources; and last but by no means least, the probable reduction of the value of the forest as a catchment area. The history of fire protection in the division so far as it is known is given below. Although crown fires have not been reported many of the older trees, especially in type IV forests exhibit fire scars to a height of 20 feet. This may be due to the fact that where the canopy is very open, high grass invades the area, and ground fires in such localities are uncommonly fierce. In areas where there is a young crop, e.g., regeneration areas and coupes below 5 years of age, fires do very serious harm, and the special protection of such areas is indicated.

59. *Injurious plants.*—Grass is indirectly injurious on account of the enhanced fire risk, and is also directly harmful in removing nutrition and moisture from the surface soil to an excessive extent, thus preventing direct access of tree seeds to the forest floor. It also provides a poor quality of humus, and excludes the more desirable species of undergrowth which would enrich the soil and give useful material for burning in regeneration

operations. It has also a definite suppressing effect on regeneration of tree species, *Pterocarpus marsupium* especially persisting for years in a suppressed condition under its shade.

Lantana is also a pest as it makes progress through the forests difficult and also has a tendency to assume a scandent habit and swamp plantations and newly cleared areas. With the exception of portions of the Kuttalam Fuel Series in Kuttalam Range, the Ullar and Sivaisalem valleys in Ambasamudram and the Mungilpatti Kidai valley in Nanguneri Range, it does not seem to be a menace in the division. If uprooted wherever seen by the subordinates its rapid spread is not likely to be a cause for anxiety.

Creepers and climbers are especially destructive in young fuel coupes and regeneration areas, as they smother young regeneration for years thus materially reducing the mean annual increment of the forest. This is particularly noticeable in the moister areas such as Kuttalam and Mundanthorai. The most harmful are *Pterolobium indicum*, *Acacia intsia*, *concinna* and *pennata* and *Zizyphus rugosa*. *Caesalpinia mimosoides* frequently forms a thick matted scandent growth and is a troublesome weed in clearings. In the evergreens enormous climbers do a lot of damage by smothering the crowns and constricting the boles of trees.

Ficus species are scattered over the forest and do some damage by suppression of the more valuable tree species and sometimes constricting the boles of trees. They are not wholly injurious however, as in the Alagarcoil valley, sandal regeneration is strikingly good under *Ficus* trees, owing probably to the fact that they attract many birds when in fruit, and these assist in dispersal of sandal seed. In the Kudiraimozhi Teri reserve *Ficus* cuttings are invaluable for afforestation purposes.

Loranthus is present but cannot be said to have assumed any serious proportions as a pest.

Prickly pear, an important pest in other divisions is hardly to be met with here owing probably to the past activities of the Cochineal insect. *Strobilanthes* is an important pest in all moist areas of the division. Its gregarious habit and its dense rapid growth enable it to cover completely large areas in short periods and thus swamp natural seedling and coppice growth completely. It is the strong light demanders like teak that suffer most. There is a clause in all fuel coupe agreements that this weed should be uprooted in all coupes wherever it occurs, but either this condition is not enforced rigorously or the treatment does not meet the case. The former view appears to be more probable, as it has been definitely proved elsewhere that cutting the weed below its prop or stilt roots has been successful as an eradication-measure. As this weed is a serious menace to the attainment of normal stocking in the fuel series rigorous measures for its eradication are called for. It appears to flower and die gregariously on the same area once in about 10 years, and a considerable revenue has been derived from its sale for fuel. Vide the table below which applies to the period 1922–33.

	Serial number and place or locality.	Amount realized.	Time allowed for removal.
		RS.	
1	Padarmalai and Koilteri Working Circle ...	150	1st July 1921 to 30th June 1922.
2	Kalakad Working Circle	105	Do. do.
3	Terku Veeravanallur	180	1st March 1922 to 30th June 1922.
4	Kadayanallur and Krishnapuram	182	15th June 1922 to 15th October 1922.
5	Athithondu section	2,200	15th January 1923 to 30th September 1923.
6	Mudangiyar section	710	Do. do.
7	Pudupatti section	700	2nd February 1923 to 30th September 1923.
8	Athithondu section	255	3rd July 1924 to 2nd January 1925.
9	Mudangiyar section	150	Do. do.
10	Mudangiyar section	215	3rd September 1926 to 2nd March 1927.
11	Puduppatti section	50	Do. do.
12	Athithondu section	405	Do. do.
13	Kadayanallur, Krishnapuram	250	26th October 1929 to 25th March 1930.
14	Kodamadi Range	215	4th March 1930 to 3rd May 1930.
15	Terku Veeravanallur (including Manpothai).	17	5th March 1933 to 30th June 1933.
16	Kalakad and Vadagarai South	33	Do. do.
17	Malayadipudur (South and North)	17	Do do.
18	Tirukurangudi and Parivarisurian (South and North).	27	Do. do.
19	Athithondu section	181	Do. do.
20	Mudangiyar section	36	Do. do.
21	Puduppatti section	51	Do. do.

Unfortunately there is no demand for the green weed or eradication measures on a large scale might have been a paying proposition, instead of being too expensive. Much can be done however to control the weed by introduction of a clause in all fuel coupe agreements, which must be rigorously enforced, insisting on the cutting of all *Strobilanthes* in the coupe below its stilt roots at the time of felling. Prompt measures taken

to sell the right to collect and remove flowering *Strobilanthes* will contribute towards minimizing the fire risk involved in having large areas of dead *Strobilanthes* scattered over the forest, and also assist in reducing the incidence of the pest, as much of the weed will be removed before it has seeded. It is essential however that removals should be capable of being adequately controlled by the subordinate staff, and for this purpose the unit of sale should be small, preferably a Forest Guard's beat, and the voidah limited to not more than three months.

60. *Fungi*.—The number and variety of the Fungi present in the division would make it a paradise to the collector. The huge bracket shaped *Polyporous* fungi seen in the evergreen sholas are a feature of the tract many of them however being saprophytic. Ground fungi, both poisonous and innocuous, are to be found scattered over the forest floor. Recently a fungus has been discovered doing great damage to and ultimately killing the young teak in patches in the plantations. The fructification has been sent to the Forest Botanist, Dehra Dun, for identification. The damping of seedlings in patches particularly in evergreen nursery beds, which are congested, is of common occurrence and should be guarded against by thinning out such beds, an operation which has been found by experience to be effective. Teak nurseries are also affected by an unidentified fungus with white underground hyphæ. Here again the disease appears to be due to congestion as, when the seedlings are notched out at an espacement of 4 inches by 4 inches, they are not effected.

61. *Insects*.—Defoliators and skeletonizers (*Hybloea puera* and *Hapalia machaeralis*) are present both in the teak plantations and to a less extent in the fuel series containing teak. Beyond a possible loss of the year's increment no more serious damage is done.

Damage by *Melolonthid* larvæ, so common a pest in nursery practice, has not yet made its appearance, but with the establishment of semi-permanent nurseries contemplated under this plan, this pest is likely to assume serious proportions.

Borer damage has not been noticed to any appreciable extent in teak. *Hopea* poles at Kariar were found killed by the borer *Massicus venustus*. In this form of damage, the point, or more frequently points, of attack were within 5 feet above ground level usually 3–4 feet. The larvæ make extensive galleries in the sap wood spirally up and down whilst young, and eventually bore about 1–1½ inches into the wood to pupate. The tree appears to die by being girdled. The damage to *Mesua ferrea* done by a Cerambycid borer, unidentified, is however much more extensive almost every tree over 1 foot girth being riddled by longitudinal and radial tunnels. The wood thus becomes quite unfit for railway sleepers, its principal use, and even under the most careful utilization the outturn in sleepers of the best trees of 7 feet girth is only in the vicinity of 35 per cent. It does not seem advisable to spend money on the artificial propagation of this species until some effective method has been discovered to control the pest.

62. *Animals*.—Elephants usually restrict their activities to the reed areas. Occasionally however they come down to the plains during the monsoons and do damage chiefly to the sandal in Alagarcoil valley. A narrow gorge has been blasted just at the point where the Mudaliaruthu-Puliuthu Bridle path crosses the Pemalai ridge. It is the belief of the ryots on the plains, that this is the *only* way whereby elephants can descend from the hills into the Alagarcoil valley, as previous to the construction of the bridle path, elephants were not known to visit this valley. With a view to preventing elephants from descending into the valley and destroying their crops, the local ryots, so they say, placed a strong wooden plank studded with big iron nails with their business points exposed upwards, across this gorge. This device was very successful in keeping the valley free of elephants for a couple of years, after which the obstruction was removed, according to the villagers, under the orders of the District Forest Officer. No official confirmation of this is discoverable in the records, but the problem of blocking the path for elephants *only* seems to be worth investigating both in the interests of the ryots and the valuable sandal growth in the valley.

Sambhur is responsible for a lot of damage to teak coppice shoots on the Mundanthorai plateau. The leading shoots are stripped of all the bark and die, being replaced by side shoots which are again similarly stripped. An enumeration carried out over a particularly bad area in the Koilteri Series showed that 88 per cent of the teak stools had been thus damaged. Fortunately this sort of destruction is restricted to the Mundanthorai plateau, where the sambhur have increased appreciably of recent years owing probably to the disturbance in the balance of nature, caused by the excessive destruction of carnivora on the plateau. Mundanthorai is an easily reached and very attractive shooting camp with the result that sportsmen frequently visit it with disastrous consequences to the tigers and panthers. Permission to shoot female and immature sambhur, with a view to reducing their numbers was accorded in 1932, but was immediately withdrawn

under the orders of the Chief Conservator of Forests as being liable to abuse in the absence of adequate control. It is considered that prohibition of the shooting of carnivora on the Mundanthorai plateau would, in time, restore the balance of nature. Fencing the whole of the annual coupe in the Padarmalai and Koilteri Felling Series where this type of damage is prevalent, is impracticable on account of the expense, as the annual coupe is about 100 acres in extent in each series and fencing for at least three years after felling would be necessary. The only course would be to organise beats for sambhur under departmental supervision with a view to reducing their numbers.

Rats and *porcupines* damage evergreen nurseries by eating up the fleshy cotyledons of young seedlings. Wild pig exhibit a great avidity for the cotyledons of *Balanocarpus utilis* but they also do good to the forest by raking up the soil in search of edible roots. Monkeys also are voracious consumers of many wild fruits and seeds; those of *Gluta travancorica* are however an exception. The leading shoot of *Artocarpus hirsuta* seedlings is frequently broken off and eaten by them. The Malabar squirrel is partial to seeds of *Dysoxylum malabaricum*, *Chickrassia tabularts* and *Acrocarpus fraxinifolius*.

63. *Grazing.*—The grazing incidence has been worked out at an average of 6·9 acres per cow unit. This is correct in theory but in practice the incidence varies inversely with the distance of the grazing area from the village. The outer slopes containing the majority of the fuel series are therefore grazed most heavily. Many of the so called hill grazing compartments are never visited by graziers owing to the fact that they are more than a day's march from villages, and penning in them has been prohibited as no agreement could be arrived at between graziers and the forest department on the important question of prevention of fires. There is however a distinct demand for the grazing in the following hill grazing compartments provided penning is permitted :—

Compartment 5 of Srivilliputtur Range.

Compartments 10 and 13 of Kuttalam Range.

A system of permitting penning in these compartments on condition that fire is rigorously excluded, would if popularized greatly relieve the present pressure on our fuel series. There is no question of the possibility of this privilege being abused by the ingress of foreign cattle, because the local ryot is emphatically not a stock breeder and the grazing on the hills is neither so extensive nor good as to attract cattle from other localities.

64. *Semi wild cattle.*—The semi wild cattle some 400 in the Kudiraimozhi Teri Reserve and about 300 in the Vallanad Reserve also do immense damage to the regeneration in these reserves, besides causing great damage to crops in the cultivated lands surrounding these reserves. These cattle owned largely by Maravas who are usually landless, are let loose in the reserves untended in order to evade the payment of grazing fees, and because local pattadars charge a higher grazing fee Re. 1 to Rs. 1-4-0 per head of cattle, for grazing in their patta lands. In times of drought these cattle feed in the forest, while when the crops are on the fields, they emerge from the forest and destroy the crops in the fields usually at night when their depredations cannot be checked. Long habitation in the forest has rendered them extremely shy of man and too ferocious to be caught. As a result of representations made to Government by the surrounding ryots, who complained of the destruction of their crops, the Maravas were at first compelled to enter into an agreement not to release their cattle from the village pen at nights. This agreement was not adhered to and in Government Order No. 554, Revenue, dated 1st March 1911, it was ordered that all semi wild cattle in Vallanad reserve should be shot after due notice to the villagers to remove their cattle. The reserve was accordingly closed to grazing as a temporary measure in July 1912 after 3 months notice in the District Gazette and shikaris permitted to shoot the cattle in the reserve without a licence. Only 4 heads of cattle were thus destroyed. The District Forest Officer subsequently reported that it would be far more satisfactory to capture the animals than to shoot them, as far less cruelty was attached to the former practice and a greater profit would result to Government as a carcass sold for about Rs. 4 while a live animal would fetch from Rs. 30 to Rs. 40 especially as they could easily be tamed in a month. The Conservator accordingly ordered that capturing was to be *preferred* to shooting.

Tenders were accordingly called for, and a very favourable one was received wherein the tenderer offered,

(*a*) to pay Rs. 20 for each head of cattle captured, cow, calf or bull,
(*b*) the material for stockades was to be provided by the department but the cost of felling and transport would be borne by the lessee,
(*c*) the period of the lease was to be one year.

This tender was unfortunately not accepted as the Conservator was averse to the grant of a one year lease in the interests of grazing; as the reserve had to be closed to grazing for this period. He also demanded a guarantee from the lessee that the whole

of the reserve would be rid of cattle, and this, the latter rightly refused to give. Departmental "Keddah" operations were accordingly resorted to in 1920–21 and a special duty Ranger and Forester posted in charge of the operations. Two stockades were erected at a cost of Rs. 788 and 26 head of cattle captured and sold for Rs. 513. A revenue of Rs. 299 was obtained by the sale of materials of the stockades; so that excluding expensive overhead charges a small profit of Rs. 24 was secured. Further details are available in R. Dis. No. 7 of 1921 of the Tinnevelly District Forest Office.

The discouraging results of departmental working led to the encouraging of private enterprise to capture the animals by netting. Licences were accordingly proposed to be granted to individuals in 1925 on condition that the 50 per cent of the sale proceeds of all animals caught would be given to the licensee. This offer did not prove sufficiently attractive, the prospective licensees sticking out for 2/3 of the sale proceeds. In 1929 a second attempt was made, the licensee being offered 3/4 of the sale proceeds of all animals caught by him. Altogether 39 animals were caught and a revenue of Rs. 360 less 75 per cent commission realised. The operation was brought to a sudden termination because one of the licensees was prosecuted and convicted, of having stolen a bullock. The supineness of the Ranger in having permitted the prosecution to take its course without aiding the licensee was a regrettable feature of the case.

The need for ridding the Vallanad reserve of these pests is pressing, if we are at all going to clothe it successfully with tree growth. The situation as far as capture of the cattle is concerned, is complicated by the fact that with the exception of a small portion consisting of fuel coupes under 6 years old, the whole of the reserve is open to grazing the grazing revenue being in the vicinity of Rs. 1,000 per annum. Thus before permitting capturing operations it is essential to close the reserve to grazing to avoid the possibility of cattle covered by permits, being captured. This not only would mean a considerable sacrifice of grazing revenue but also would involve hardship on the surrounding graziers who have limited grazing grounds. The best step under the circumstances would be to close the reserve during March—May when cattle can be fed on the fallow land surrounding the reserve, and by the organisation of beats by the Range Officer or District Forest Officer, to destroy as many of the cattle as possible by shooting. A great deal in the way of extermination can be done in 3 months by an energetic posse of subordinates. Capturing operations are not likely to meet the case as the ryot who owns the cattle knows that he can claim them when captured, or failing this buy them cheaply at the ensuing auction and put them back in the reserve for grazing. These alternatives are not present in the case of a dead animal. Not until owners are convinced that the conversion of these reserves into private grazing grounds principally for their benefit, will not be tolerated, will the problem of semi wild cattle be solved.

65. *Man.*—Situated as the forests are, close to cultivation on the populous plains, it is not surprising that the forest offences reported are numerous. The blood of their marauding and pillaging ancestors still runs, although in an attenuated form, in the Maravan and Thevan of to-day. The result is a constant defying of authority, and subordinates are frequently intimidated by the young bloods of the village so that many offences are not reported by them. One useful result of this however deserves comment. The District Forest Officer is almost invariably informed by the ryots by numerous anonymous or pseudonymous petitions as soon as the illegal acts or exactions of particular forest subordinates have become too oppressive. Many of these petitions are patently exaggerated but careful enquiry will almost invariably disclose a substratum of truth. Illicit grazing in closed areas and illicit felling of small timber and fuel are the principal offences. The ryot wants a particular shaped piece of timber for his plough and usually prefers to get it himself from the forest, and take what he considers the paltry risk of being caught, rather than get it from the stock in the forest contractor's depot. Protection against injuries from man however, generally good except in the Rengarcoil beat of Srivilliputtur Range, the Vasudevanallur beat of Kuttalam Range, the Kadayam beat of Ambasamudram Range, and the Kalakad beat of Nanguneri Range, where there is much room for improvement.

66. *Manure leaf.*—The removal of manure leaf from the forests of Nanguneri and Srivilliputtur Ranges is permitted on payment of 2 annas 6 pies per head load. The revenue realized for the decennium 1922–23 to 1931–32 is shown below :—

Year.	Nanguneri. RS.	Srivilliputtur. RS.	Total RS.
1922–23	4,375	—	4,375
1923–24	—	—	—
1924–25	4,814	3,771	8,585
1925–26	3,467	3,753	7,220
1926–27	3,703	98	3,801
1927–28	4,453	1,394	5,847
1928–29	1,836	141	1,977
1929–30	2,171	960	3,131
1930–31	1,754	691	2,445
1931–32	624	554	1,178

This pernicious system once prevalent over the whole division has been partly responsible for the progressive deterioration of the Simple Coppice Fuel Series on the lower slopes of the ghats. In theory no removals of leaves of fuel and timber species is permitted but in practice it is difficult to enforce this. In the interests of conservation a bold policy of closure of the forest to such removals is indicated. Such a policy has been successfully adopted in Madura division the reserved forests of which at one time were the biggest suppliers of manure leaf in the Presidency.

67. *Illicit offences.*—The following statement shows the number of cases reported under the main heads for the decennium, 1923–24 to 1932–33.

Number of forest offences.

	Grazing.	Felling.	Hunting and fishing.	Assault on subordinates.	Miscellaneous.	Total.
1923–24	209	499	3	1	13	725
1924–25	210	510	8	—	15	743
1925–26	185	540	12	—	7	744
1926–27	127	475	7	1	12	622
1927–28	186	511	4	—	12	713
1928–29	187	521	10	1	6	725
1929–30	176	441	—	1	8	626
1930–31	163	396	5	1	17	582
1931–32	183	498	10	1	11	703
1932–33	123	376	9	—	18	526

The average annual revenue derived from compounding fees in the division during the above decennium was Rs. 4,849.

SECTION 3—FAUNA.

68. *General.*—The scarcity of game has been a lament of every Forest Officer for the last decade. Wild pig, spotted deer and sambhur are still fairly numerous on the Mundanthorai plateau, and in Puliangudi and Vasudevanallur beats of Kuttalam Range. Elsewhere, especially round Kuttalam, in the Sivaisalem hills and in the Kalakad Series, with the exception of pig, game is very scarce. Illicit shooting in these three localities has assumed serious proportions, and there is little doubt that the forest subordinates connive at, and derive a considerable revenue from this poaching, as venison is highly prized among the local population, and skins are esteemed as household adornments. Professional shikaries are numerous and display an almost uncanny knowledge of the principal water holds and salt licks round which old *machans* are almost invariably seen. Since, in the long hot weather, game is forced to visit such places owing to the general scarcity of water, its destruction is comparatively easy. The grant of licences to the local population, ostensibly for the protection of their field crops, is also largely responsible for this destruction, as they are utilized for hunting in the reserved forest. Licences issued specifically for the pursuit of game in the reserved forests are comparatively few, averaging 25 for the decennium 1923–32. Game preservation would be greatly assisted were it possible to restrict the gun licences issued to the local population; but this, apparently, is opposed to the declared policy of Government. Failing this, game preservation could be promoted by the following measures :—

(1) The exercise of a greater amount of discretion in the issue of shooting licences. There is a ' black list ' maintained in the District Forest office which does not appear to have been consulted in the issue of shooting licences. A licence for retainers should be issued only if the District Forest Officer is convinced that the licensee is not likely to abuse the privilege. It is deplorable that many so-called sportsmen take out a licence only to enable their retainers, usually skilled shikaris, to shoot game for them. Such a lack of sportsmanship should be rewarded, on discovery, by the posting of delinquent's name on the ' black list.'

(2) Forest subordinates should be rewarded on a more generous scale for good work in game preservation; at present, considering the temptations to venality, it is hardly surprising that many of them follow the more profitable line of least resistance.

Finally, it must be emphasized, that no satisfactory conservation of game can be accomplished unless the District Forest Officer is personally enthusiastic in the matter, and shows his subordinates that he is interested, both by rewarding good work generously and by punishing bad protection severely.

Black buck is fairly common in Vallanad reserve, and merit special protection, as they have disappeared from the panchayat areas where they were once numerous.

Bison.—There is a small herd of bison which frequents the sholas and grass areas around Netterrikkal. Bison spoor has also been observed in the Mungilpatti Kidai valley of Nanguneri Range. Elsewhere in the division they are absent.

Carnivora.—Tiger and panther are found occasionally mainly on the Mundanthorai and Kalakad plateaus. The shortage of game probably accounts for their comparative rarity elsewhere.

Bear.—The black bear haunts the shola forests throughout the division.

Ibex.—Ibex are found scattered over the division, their main habitat being the precipitous and grassy hills above 4,000 feet elevation. The principal haunts of this animal are :—

Nanguneri Range.—Tiruvannamalai, Naduterrimottai and Panjantangimottai.
Ambasamudram Range.—Chinnaadoomottai and Periadoomottai.
Kuttalam Range.—Variadoomottai, Generals Hill and Kulirattimottai.
Srivilliputtur Range.—Peimalaimottai and Sambangikidaimottai.

The localities in Ambasamudram Range are the most easily accessible and are therefore the most heavily poached. The need for preserving this interesting and rare wild animal from rapid extinction is very pressing.

Barking deer are comparatively rare though fine specimens in the Puliangudi beat of Kuttalam Range have been seen.

The sholas contain monkeys mainly of the langur variety and the Malabar squirrel is quite common.

69. *Game birds*.—The Jungle-Fowl is common throughout the division. Partridge is to be met with in Type I forest, principally in Vallanad, Rangarcoil and Valaikulam reserves. Green-pigeon is fairly common on the inner slopes especially along the various stream and river banks. The imperial pigeon is comparatively common in the less accessible shola forests.

Other birds of note in the shola forests are the Greater Horn-bill, the Whistling School Boy, the Racket-tailed Drongo, the Scarlet Minivet and the Hill Mynah.

In the lower forests the usual bird life of South India is abundantly represented, and many most beautiful birds as the Paradise Fly-catcher, the Golden Oriel, the Barbets, the Red-Vented Bulbul, etc., are frequently to be seen.

70. *Snakes*.—The Hamadryad is alleged to frequent rivers and streams in the shola forests but we are not able to confirm this. The Cobra and the Krait are however too common for comfort especially in the wooden sheds in the hills. Rat-snakes are frequently to be met with but are not poisonous.

CHAPTER III.—UTILIZATION OF THE PRODUCE.

SECTION 1.—AGRICULTURAL CUSTOMS AND WANTS OF THE POPULATION.

71. *Population*.—The population of the Tinnevelly district according to the latest census of 1931 excluding Anjengo sub-taluk amounts 2,040,141 or on an average to 473 to the square mile. The only taluk of Ramnad district with which we are concerned, namely, Srivilliputtur, has a population of 233,683, or 536 to the square mile.

The population is mainly agricultural, both dry and wet crops being grown. Rice cultivation occupies one-fourth the total cultivated area of the Tinnevelly district, the proportion in Ambasamudram taluk which possesses the best wet lands irrigated by the Tambraparni rising to two-thirds.

72. *Wants of the people*.—The chief forest requirements of the people are small timber for building and agricultural implements, fuel for domestic consumption and for cottage industries such as jaggery-making, lime and brick-kilns, pottery, etc., pasture for cattle, thatch-grass, and to a decreasing extent, leaf manure for the wet cultivated fields.

73. *Agricultural implements*.—The farmers stock in trade of implements is small; a light wooden plough for use in puddled fields, and a slightly heavier one for use when the field ploughed is in a comparatively dry state for broadcast sowing; a wooden plank for use in levelling the surface in wet fields, a *manvetti* or spade for light hoeing and clod-breaker for breaking up the ploughed up soil.

The plough consists of the handle, plough-share, shaft and yoke. Of these the plough-share requires most frequent renewal as it is most subject to wear. It has been ascertained from enquiry among the ryots that the plough-share has to be renewed annually for dry cultivation and biennially for wet cultivation, the average stock of plough-shares required being one per acre of cultivation. The remaining portions of the plough are only renewed triennially. The following table shows the species most prized for the various parts of a plough and other agricultural implements in the order of preference :—

Plough-share.—*Chloroxylon swietenia, Acacia arabica, Albizzia amara and Mesua ferrea.*

Shaft.—*Mesua ferrea*, *Grewia tiliæfolia*, teak.

Handle.—Teak.

Yoke.—*Pterocarpus marsupium*, teak. In addition any other species most easily available are used for the yoke and the handle.

The species most in demand for parts of country carts are in the order of preference :—

Spokes.—*Aglaia roxburghiana*, *Grewia sp.*, teak.

Felloes.—Teak mostly.

Chattams.—*Acrocarpus fraxinifolius*, *Dipterocarpus bourdilloni*, *Hardwickia pinnata*, *Palaquium ellipticum*, *Pterospermum rubiginosum*.

Vandipoles.—*Palaquium ellipticum* and *Hardwickia pinnata*.

Axle boxes.—*Hardwickia binata*, *Acacia arabica*, *Pterocarpus marsupium*.

74. *Houses.*—In the rich Tambraparni valley tiled houses are common, only the houses of the poorer labourers being thatched. In all the villages lying along the foot of the hills, thatch is rapidly giving place to tiles as a roofing material and this naturally means more substantial buildings of brick or stone and mud. Kongu (*Hopea parviflora*) a timber which possesses a peculiar fascination for the people of the division, is very extensively used even in preference to teak for building material, the local slow grown teak being highly prized for door and window frames and rafters. In the sparsely populated Koilpatti taluk where incendiarism is too common a pastime of the ryot, substantial houses are rapidly replacing the old mud walled and cumbu stalk thatched houses.

75. *The Palmyra.*—There is no single product of the division which provides an occupation for so large a number of its inhabitants as the palmyra (*Borassus flabelliformis*). There are over 10 millions of them scattered over the whole of the plains of the division, and a large number in the Kudiraimozhi Teri Reserve ; it has been estimated that roughly five per cent of the population depend for their livelihood upon this tree. An ancient Sanskrit poem enumerates 801 uses to which the tree can be put, and a local Tamil proverb declares with more exaggeration than truth, that the palmyra lives for a thousand years, and continues to last when cut for another thousand years. Its durability is however unquestionable and accounts for its extensive use as rafters. Fibre for brushes and rope making is extracted from the leaf stalk which is also used as fuel. The leaf is used for thatching and basket making. The tender fruit, contains a translucent jelly like endosperm which is greatly relished. The inflorescence on both male and female trees, is tapped for the sap which exudes from it.

The tapping season commences in February and continues up to June. The daily yield of a normal tree varies between ½ to 1 Madras measure according to the number of spathes tapped. Left to itself the juice quickly ferments, and if fermented sap or toddy is not required, the interior of the pot is lined with lime. Only a small proportion of the sap produced in the division is utilized for consumption either as a sweet drink (pathnir) or as fermented liquor. The rest is boiled to produce either a coarse sugar known as jaggery, or more rarely, is purified into palm candy sugar. The boiling of palmyra sap is thus an important industry consuming large quantities of fuel of small dimensions, below 6 inches girth, as the larger sized fuel is useless for the purpose, a quick hot fire being the principal desideratum.

76. *Mats.*—Mats of varying degrees of coarseness (the maturer the leaf the coarser the mat) are made from palmyra leaves in large quantities both for export and local consumption. Excellent mats of *korai* grass are manufactured, mostly by Muslims, the price varying from Re. 1 to Rs. 35 per mat according to the texture.

77. *Small timber.*—The small timber that the Government forests supply, judging from the contractors accounts of removals for the decennium 1923–32, amounts on an average to about 1,500 tons per annum. The demand is estimated to be in the vicinity of 5,000 tons per annum. The balance has been met principally from the adjoining Travancore State and the Zamin forests, and to a lesser extent from the extensive patta lands of the Nanguneri mutt in Nanguneri taluk and the Tiruvaduthurai mutt in Tenkasi taluk. Owing to unrestricted cutting and felling under too short a rotation (10–15 years) the supply of small timber from the Zamin forests is likely to disappear in two or three decades. The necessity for conserving and extending our resources in this respect is indicated.

78. *Fuel.*—The fuel requirements of the division are very large. Mr. P. M. Lushington as a result of personal investigations in 1919 estimated the fuel consumption to be in the neighbourhood of 200,000 tons per annum. The village and rural demand is comparatively insignificant as the ryots use mainly palmyra, cotton and castor stalks, palmyra leaves, cowdung cakes and such brushwood fuel as is obtainable on village grazing grounds. A common agricultural custom of the ryot in the plain taluks deserves mention. Where the soil is too poor to yield an annual crop, the ryot after harvesting his crop, pens sheep and goats fed on *Acacia planifrons* pods on the land. The passage of the seed through

the alimentary canal of these animals, appears to have a remarkable effect on its germinative capacity. The dung mixed with seed which is obtained, is broadcast on the ploughed ground and if the rainfall is propitious, a crop of young seedlings soon results. This is carefully guarded from goats, etc., and within 6–8 years the plot is felled over and recultivated with field crops. The fuel from this source forms a valuable supplement to agricultural income, besides improving the fuel supply of rural areas which have been denuded of practically all natural tree growth. Again there are a number of areas scattered over the plains, chiefly tank-beds, over which under the provisions of rules framed under section 26 of the Madras Forest Act, the Forest Officer exercises a very limited control. These areas, some 18,000 acres in extent, known as " Unreserved lands " are under the direct control of the revenue authorities. The chief growth consists of babul (*Acacia arabica*), the wood of which is in great demand for fuel and agricultural implements. No restriction of grazing is enforced in these areas, and this combined with the fact that babul does not coppice, has resulted in the progressive destruction of this important fuel resource in the plains. The revenue from this source which averaged Rs. 15,000 per annum in the eleven-year period 1885–86 to 1895–96—has now dropped to an average of Rs. 1,160 per annum for the decennium 1923–1932.

It is only from the villages situated near the hills that women, and less often men, go and spend their time in the fuel coupes collecting fuel on payment to the contractor of seigniorage varying from 3 pies to 2 annas a head-load according to the quality of the fuel and the demand. It is the policy of the Forest department to distribute fuel coupes as widely as possible with the object of bringing cheap fuel to the ryots' door.

The larger fuel in the more remote fuel series is usually converted into charcoal *in situ*, for which there is a keen demand. From the fuel series situated within economic distance of the railway, the larger fuel is transported to the big towns, Tinnevelly and Palamcottah consuming some 40,000 tons of which Government forests supply only about 5,000 tons. The contractors of the fuel series situated in the northern part of the division, namely, the Puliangudi, Karuppusamikoil and Vasudevanallur Series in Kuttalam Range and Ayyanarkoil Series in Srivilliputtur Range, find it more profitable to transport their fuel to Madura by rail for sale.

As far as small timber and fuel is concerned it will be seen that no one, least of all Government, possesses the monopoly of supply, and market rates are consequently low. The fuel problem reduces itself therefore to a question of economics. There is always a demand for fuel which can be extracted at a rate below the prevailing market rate, over which we have no control.

79. *Timber.*—Big timber for constructional work is largely obtained from the Travancore State forests by rail through the Shencottah pass, and by road through the Achenkoil and Aramboli passes. Teak, *Hopea parviflora*, *Dalbergia latifolia*, *Dipterocarpus bourdilloni*, *Adina cordifolia*, *Mangifera indica*, *Artocarpus hirsuta* and *Vitex altissima* are the principal timbers exported. The annual output of the Shencottah division of the State Forest department, as far as evergreen timber is concerned can be judged from the current year's working (1932–33).

	CUBIC FEET.
Hopea parviflora	76,000
Dipterocarpus bourdilloni	82,670
Miscellaneous species	17,000
Total ...	1,75,670

Favourably situated as this division of Travancore State is, right on the Tinnevelly frontier, more than 75 per cent of its annual output is sold to merchants from the Tinnevelly, Ramnad and Madura districts.

A certain amount of timber, mainly " jungle wood " is supplied principally to the sea ports of Tinnevelly from the west coast, the transport being effected by native craft.

Burma teak enters the Tinnevelly division at Tuticorin and is largely used for the best constructional work, being conveyed by rail to most of the principal towns in the district. The quantity of such timber imported for the triennium 1928–29 to 1930–31 is given below :—

	CUBIC FEET.
1928–29	69,200
1929–30	107,600
1930–31	84.850

Besides this, there is a vast and annually increasing output of teak poles from the thinnings of the Travancore State teak plantations which were 10,672 acres in extent in 1930–31, and are increasing at the rate of approximately a square mile per annum. The felling of the final crop has not yet been started, the oldest crop being now about 65 years old and the tentative rotation 70 years. The decision of the State, repealing the statute declaring teak and rosewood " Royal trees," from 16th August 1941, has resulted in the concentration of the State Forest Department's activities on the extraction of all exploitable trees of these species found on private holdings, on a regular plan. The result has been over production and a consequent fall in the prices of these valuable timbers in the markets of the division. The people have a strong prejudice, consecrated by centuries of usage in favour of teak, and with the fall in prices of this timber the difficulty of marketing our lesser known and less durable evergreen species at a profit has been increased. The only big timber which the division can supply is evergreen timber, both the rainfall and soil conditions prevailing over most of the forests not being conducive to the production of big timber of deciduous species. The local demand for evergreen timber has been estimated by various Forest Officers to be about 10,000 cubic feet. Investigations made into the demand point to a much higher figure, namely, 40,000 cubic feet for the Kallidaikurichi market alone. Here again the crux of the problem lies in economic working. If extraction costs are kept below the prevailing market rates which are governed principally by the output of the Shencottah State forests and Singampatti Zamin, there would be no difficulty in disposing of the whole of the output under this plan.

80. *Sandalwood.*—Up to date, following the prescriptions of Mr. George Venugopal's tentative working plan, only dead trees and trees broken by elephants have been extracted from the Alagarkoil valley of Srivilliputtur Range under the Sandalwood Extraction Rules, the mean annual yield being in the vicinity of 3½ tons. Extraction was started in 1923–24 but unfortunately the work was not done in accordance with the Sandalwood Extraction Rules, till 1930–31. A list of dead sandal trees in girth classes extracted from the Alagarkoil valley is given below, for the years 1923–33, as far as statistics are available :—

Year.	Girth class. 0″—6″.	6″—12″	12″—18″.	18″—24″.	24″—30″.	Total.	Total yield of final cleaned wood. TONS.	QRS.	LBS.	OZ.
1923–24	..	..	..	..	..	110	..	62	4	8
1924–25	10	39	21	1	..	71	..	49	10	8
1925–26	..	..	..	..	..	98	..	63	12	0
1926–27	..	..	..	..	..	295	1	68	1	..
1927–28	..	..	..	..	..	169	1	16	18	12
1928–29	..	..	..	..	..	..	..	65	8	8
1929–30	..	..	..	..	..	331	4	32	4	14
1330–31	1	235	185	31	4	456	4	3	5	..
1931–32	9	600	344	36	1	990	8	18	24	..
1932–33	73	813	329	43	4	1,262	10	66	15	8

All the sandal extracted in the division is final cleaned and sent to the Tiruppattur sale depot where it is auctioned along with the Vellore sandalwood. The local demand, mainly for religious ceremonies and household use is met by private merchants who import the wood *via* Tuticorin from Bombay. This sandal is mainly Australian, and the billets are beautifully cleaned and polished. Although it is inferior to Indian sandal in scent and oil content, it is bought wholesale at Rs. 1,260 per ton and sold retail in Tuticorin at 1,344 per ton. The annual imports of this wood into the port of Tuticorin are given below :—

	Weight. TONS.	CWT.	LB.
1922–23	32	16	28
1923–24	18	5	84
1924–25	44	4	56
1925–26	41	14	0
1926–27	26	3	40
1927–28	39	8	84
1928–29	41	15	28
1929–30	32	12	56
1930–31	25	15	28
1931–32	18	0	56

The average annual imports amount to 32 tons. The annual demand in Tuticorin is about 2 tons, in Palamcottah and Tinnevelly about 4 tons, the rest of the division taking, according to the sandalwood merchants, about 2 tons. The greater quantity of the imported sandal is sent to Trichinopoly and Madura, where it is used both for *bona fide* religious and domestic purposes, and for illegal purposes, such as adulteration of the sandal illicitly abstracted from the reserved forests of the South Salem division. The need for exercising the greatest circumspection in the registration of property marks and the grant of way permits is indicated.

There is some sandal in the patta lands adjoining the reserves in Srivilliputtur and Kuttalam Ranges. Neither its distribution nor its value call for special comment. The local pattadars do not seem to set much store by the sandal on their holdings and none of it is extracted for commercial purposes. The Sembaga tope, an area of about 300 acres at the mouth of the Alagarkoil valley in Srivilliputtur Range, is owned by the Srivilliputtur Temple Trustees, and contains an excellent growth of young sandal, sample enumerations disclosing the presence of about 8–10 trees per acre about 6 inches girth. Extraction here is being done on a very small scale for the purpose of supplying the needs of the temple only. Although this crop is immature, the sandal is spreading rapidly and in time should be valuable.

The position in this division as regards patta sandal is quite different from that in other divisions, for example, North Coimbatore, as Government here has no right whatsoever to any of the sandal on patta lands. As the quantity available is small and as much of the regeneration is periodically destroyed by burning by the pattadar, who is seemingly unaware of its value, the rapid spread of the sandal on patta lands is not probable; moreover the difficulty of enforcing any " agreements " will be great, since in this division such agreements will be unilateral (unless consideration is paid at the time of execution of the agreements) and therefore unenforceable by law. Adequate control over patta sandal working can be obtained by having recourse to the Sandalwood Transit Rules (Appendix III), recently introduced in the division. In addition to this, it will be prescribed that attempts be made to induce pattadars to sell their dead sandal to us for extraction—vide paragraph 532 below.

81. *Bamboos.*—Bamboos form quite an insignificant proportion of the crop in the division. There is a great demand for this product, especially in the large towns, for erection of scaffoldings, pandals, fences, etc. Of recent years Messrs. Harvey & Co., have started using bamboo slats experimentally, for packing their cotton for export, and an extension of the demand may be anticipated. The supply at present is almost wholly met from the Travancore State forests; and therefore, favourably situated as many of our reserves are from the point of view of extraction, the artificial introduction of bamboo in suitable areas seems desirable. In this connexion it should be borne in mind that the bamboo is a comparatively cheap product; hence it should be introduced only in localities where transport facilities permit of low extraction costs. The introduction of *Dendrocalamus strictus*, is not favoured as the optimum elevation for this species 2,500 feet–3,000 feet, would preclude its introduction in localities from which it could be profitably extracted. *Dendrocalamus brandisii*, however has been successfully raised at elevations 5–600 feet in the Wynaad division and its experimental introduction in this division in favourable localities is desirable. *Bambusa arundinacea* has been grown in the division at elevations varying from 300 feet to 1,200 feet, although on a comparatively small scale, and the extension of such plantations as are economically situated will be prescribed.

82. *The Eta reed.*—This produce is at present worked sporadically through the agency of minor forest produce contractors, who issue head-load tickets for its extraction from any locality in their respective farms where it occurs. This method of extraction touches only an insignificant proportion of the vast reed areas in the division, only the most easily accessible areas being worked. The annual amount extracted is about 70 tons. Enquiries made into the possibility of working the more easily accessible areas by the system of located fellings by coupe contractors, have definitely pointed to the fact that there would be no demand for such coupes. The reed is of potential value as a source of paper pulp, and since details as to the best method of working it on the basis of a sustained yield would be valuable, in case the development of hydro-electric schemes provides a cheap source of power and make the establishment of paper mills possible, such details as are available as given below :—

Area.—As a result of stock mapping done by the Forest Engineering Branch in 1925–26, 28 square miles of reed jungle of which 17 square miles consisted of pure reed and 11 square miles of mixed reed and tree growth, were located in Ambasamudram Range. The latter was estimated to contain 60 per cent reed growth. Thus the total reed area available amounts to $17 + (11 \times \frac{60}{100}) = 23{\cdot}6$ square miles or about 15,100 acres.

Method of working.—Sylviculturally, clear-felling of the reed was found experimentally to be detrimental to its regeneration. The following statement

illustrating this, shows the results of experiments made by the District Forest Officer in 1925 :—

Original reed growth	Date of observations. March 1925.	June 1925.	March 1926.
Plot A— Half acre—Thick, with large sized culms and few trees.	Clear felled ..	Regeneration fair.	Shoots less than 5 feet high and 1 inch in girth. All shoots short, many broken by elephants.
Plot B— Half acre—Poor, culms small ..	Do. ..	Regeneration poor.	Regeneration dense, shoots less than 3 feet high.
Plot C— Half acre—Same as plot A ..	60 per cent the culms in each clump felled.	Regeneration good.	Except for the presence of new culms the clumps in this plot show no signs of exploitation : new culms 3 to $3\frac{1}{2}$ inches in girth and about 15 feet high.

N.B.—The plots were near Kalavelipil in Ambasamudram Range.

The following details derived from enquiries made by Mr. A. Wimbush in 1925 in Travancore are also illuminating, and to some extent corroborative :—

(1) Clear-felling of reeds is fatal to the maintenance of a sustained yield. It is considered that if a clump is clear felled it will have to be left alone for seven years in order to recover.

(2) Provided that a sufficient number of culms are left to feed the rhizomes, a felling cycle of four years is probably sufficient.

(3) The smothering of cut-over clumps by the refuse from felling is to be deprecated, but the only District Forest Officer consulted on the point thought that burning of the debris would be much more injurious.

Exploitation.—In order to test the utility of this reed for making paper pulp, 2 acres of pure reed jungle near Woods hut, were clear-felled departmentally in 1926, and the produce sent to the Forest Research Institute, Dehra Dun. The yield was $17\frac{1}{2}$ tons of green weight or $11\frac{1}{2}$ tons of air dried weight of reed. This gives an output of $5\frac{3}{4}$ tons of air dried reed per acre under clear-felling or an yield of $3\frac{1}{2}$ tons of air dried reed per acre if only 60 per cent of the crop is felled. It must be added that all top ends, leaves and branches have been excluded from these calculations. On this basis the reduced area of 15,000 acres, represents a total yield of 52,500 tons of air dried material. Under a felling cycle of three years the annual yield would be 17,500 tons. According to the Paper Pulp Expert 2 to $2\frac{1}{2}$ tons of air dried reed would be required for a ton of paper pulp. Taking the higher figure therefore, the supply is sufficient for manufacturing 7,000 tons of paper pulp annually. The total cost of extraction and supply to rail head (Ambasamudram) amounted to Rs. 111 per ton air dried weight. As the reed had to be supplied at short notice, the work of extraction could not be well organized or controlled. The District Forest Officer at the time, held the opinion that with proper organization the cost of delivery at Ambasamudram could be reduced to Rs. 85 per ton, with the existing methods of transport.

Under the direction of Mr. Raitt, the officer in charge of the Paper Pulp section at Dehra Dun, the reed sent from the division was converted into paper. He was of opinion that the reed made first-class paper pulp, yielding a fibre of exceptional length and slenderness, i.e., softness and felting quality. It was suitable for any grade of high class art printing and litho paper, being exceptionally free from dirt and matter producing objectionable specks on the paper. The cost of manufacture per ton of paper was :—

	RS.	A.	P.
(1) Chemical process	20	8	0
(2) Bleaching	21	0	0

Mr. Raitt suggested that if a mill was erected at Mundanthorai about 10–12 miles from the reed areas in a straight line, the dry reed could be delivered at the mill at Rs. 15 per ton with the assistance of ropeways. Thus, on the basis of $2\frac{1}{2}$ tons of dry reed to 1 ton of paper, the cost of the reed would be Rs. 37–8–0 per ton of paper. There was a prospect therefore the cost of raw material and chemicals up to the bleached pulp stage amounting to only Rs. 79 a ton, a figure which was not approached by any other raw material in the world. (The corresponding figure for the grass which is the staple for North Indian paper makers is Rs. 200 per ton and for the bamboo mills Rs. 160 per ton.)

Since the reed was a patch flowering species and was not known to flower gregariously the question of stoppage of supplies during a general seeding did not arise.

This satisfactory report by an expert who was universally known to be an authority on the subject, interested a number of European firms in the subject. Messrs. John Dickenson & Co., Ltd., may be quoted as an example; they stated their case as follows :—

(1) The scheme was highly speculative and not sufficiently attractive unless Government was prepared to share the risk.

(2) The location was poor for a paper factory being very far from principal markets.

(3) Hence before considering the scheme further, the company would like to know if the Government were prepared to—

(*a*) construct power installation and provide power service to the factory at a low rate;

(*b*) grant a concession for the rights to cut and remove the reed on a seigniorage of Re. 1 per ton of dry material;

(*c*) contract to take a proportion of the factory output of not only paper, but envelopes, bags, account books, etc.;

(*d*) obtain railway freight concessions; and

(*e*) guarantee a certain interest on the investment, say $3\frac{1}{2}$ per cent until the factory had reached a profitable stage.

In return for these concessions the company was prepared to erect a mill capable of utilizing 4–5,000 horse-power of electric energy with an approximate outturn of 5,000 tons of paper per annum.

The Chief Engineer, Hydro-Electric Division, reported that the consumption of 5,000 horse-power only of electrical energy would not justify expenditure on the hydro-electric scheme. Attempts were then made to attract the attention of the cellulose and artificial silk interests to the scheme, with the idea of increasing the demand for power, but these met with no success. The scheme was therefore dropped on the advice of the Chief Forest Engineer as " not being commercially feasible at present." The preliminary investigation into the various ropeway, railway and flume transport schemes, carried out by the old Forest Engineering branch at considerable expense, proved disappointingly unproductive. The Chief Forest Engineer's Dis. No. 6153 of 1927, contains :—

(*a*) The survey of meter gauge railway from Ambur to Mundanthorai and proposed dam site with an extension to Kodamadi.

(*b*) Survey of main flume from reed areas to proposed impounded lake near Taravittanparai and one branch flume tapping the western portion of reed area.

(*c*) Maps of proposed ropeway routes and flume routes.

(*d*) Reconnaissance maps of Singampatti and Kalakad forests showing reed areas. All these details being now merely of academic interest are not embodied in this plan, but are filed in the Forest Engineer's office.

83. *Manure leaf.*—The removal of manure leaf from the forest on payment of 2 annas 6 pies per head-load is permitted only in the Nanguneri and Srivilliputtur Ranges. It is rather surprising that although the wet cultivation in the plains in the Ambasamudram and Kuttalam Ranges is even more extensive than that in the plains in the neighbourhood of the reserved forests of Nanguneri and Srivilliputtur, yet manure leaf removal is prohibited in the former, while it is allowed in the latter ranges. Since many of the ryots in Nanguneri and Srivilliputtur have started growing their own manure leaf—kolinji (*Tephrosia sp.*)—under the aegis of the Agricultural department, a proposal was put forward by the District Forest Officer in 1930 to enhance the rate for manure leaf to 4 annas per head-load from 1931, so as to compel the ryot to grow increasing quantities of his own manure leaf and to rely to a diminishing extent on the forest supply. This proposal was supported by the Collector of Tinnevelly, but the Collector of Ramnad, while accepting the principle involved, considered it impolitic to raise rates at a period of acute agrarian distress. The Chief Conservator of Forests agreed with the Collector of Ramnad and ordered that the proposal should be held in abeyance until agricultural conditions improved. The cultivated manure leaf, kolinji is at present sold at Rs. 12 a cart-load. With agricultural labour available at 4 annas per diem the cost of one cart-load or 20 head-loads of manure leaf from the forest would be only Rs. 8 even on the assumption that a labourer can harvest only one head-load of such manure leaf per diem. It is obvious that the ryot has little or no incentive at present to grow his own leaf manure. Two alternatives are open to us. The first is to raise the rate for manure leaf from the reserves to 4 annas per head-load immediately. This will not only bring the price of the leaf more in line with its market value, but also serve as an incentive to the ryot to increase cultivation of his own manure leaf. The second alternative is the application of closure of the reserves to manure leaf removal, after perhaps a year's notice in the District Gazette. While immediate prohibition of removals would probably cause hardship to the ryot and possibly result in the demand being met illicitly by collusion with forest subordinates, the raising of the rate to 4 annas per head-load would, on the other hand, do good both to the forest and ultimately to the ryot, in that the latter would be compelled to grow his own supply. Unfortunately the damage to the forest cannot be localized by the prescription of leaf manure felling series, as practically the whole of the outer slopes containing tree growth have been constituted into fuel felling series, and the ryot would find it uneconomic to go beyond the fuel series for his supply owing to the distance and the relative absence of the kind of leaf manure that he requires.

84. *Grazing.*—The forests above approximately the 1,500 feet contour are very steep and consequently not suited for grazing either from the point of view of the grazier or of the Forest Officer. They are covered with shola forest, thin semi-deciduous forest or tall coarse grass; this latter provides grazing of poor nutritive value but is rarely eaten by cattle; if burnt however, a crop of tender shoots is soon produced which is quite palatable to cattle. In the interests of the preservation of the water sources on which the irrigation in the plains depends, it is essential to protect such areas from fires; this can be accomplished only by prohibiting grazing in such areas.

The forests below 1,500 feet are for all practical purposes, the only areas from which the pastoral requirements of the people can be supplied; owing to the keen demand for fuel, small timber and charcoal, the fuel coupes give an average annual revenue *per acre* varying from 8 annas in Kolunthamamalai Felling Series to Rs. 2–7–0 in Kuttalam Felling Series. If it is admitted that the grazing of half a cow unit per acre per annum would practically mean the destruction of the whole forests in time, it seems much the same as saying that the Forest department are charging 4 annas per acre for what they might legitimately charge at least Rs. 1–8–0.

The following table shows the various grazing compartments into which the forests are at present divided, together with an approximate estimate of the area available in each compartment for grazing. This estimate has been arrived at by excluding all areas over the 1,500 feet contour (as such areas are seldom if ever visited by cattle) and areas closed annually to grazing for sylvicultural reasons or for the protection of bison.

Name of compartment.	Actual area.	Area closed annually.	Area inaccessible.	Area available for grazing.
	ACS.	ACS.	ACS.	ACS.
Srivilliputtur Range—				
Ayyanarkoil	8,128	924	2,797	4,407
Valaikulam	1,530	470	...	1,060
Mamsapuram	3,000 }	448	1,299	4,397
Rangarkoil	3,144 }			
Rangathirthum	3,253	...	99	3,154
Pudupatti	5,535	630	1,860	3,045
Khansapuram	2,396	...	...	2,396
Chittar	5,886	...	5,288	598
Total ...	32,872	2,472	11,343	19,057
Kuttalam Range—				
Kuttalam, west	1,691 }	775	{ 326 }	1,632
Kuttalam, east	1,234 }		{ 192 }	
Mathalamparai	1,681	...	672	1,009
Pumbli	506 }	473	{ 134 }	624
Vadagarai	815 }		{ 90 }	
Chinnakadu	1,389 }	..	{ 877 }	1,318
Palayar	1,852 }		{ 1,046 }	
Krishnapuram	3,207	342	2,017	848
Puliangudi	2,705	669	51	1,985
Karupasamikoil	2,953	677	672	1,604
Vasudevanallur	2,957	769	844	1,344
Puliangudi Hill	3,346	...	3,160	186
Vasudevanallur Hill	4,635	...	4,552	83
Total ...	28,971	3,705	14,633	10,633
Ambasamudram Range—				
Koilteri	2,375	542	75	1,758
Aladiyur	3,000	...	90	2,910
Vikramasingapuram	2,998	312	20	2,666
Ambur	2,800	418	...	2,382
Sivaiselvam	3,000	...	758	2,242
Kadayam	2,000	...	683	1,317
Govindaperi	3,200	...	666	2,534
Padaramalai	3,993	...	180	3,813
Total ...	23,366	1,272	2,472	19,622
Nanguneri Range—				
Kolunthamamalai	2,781	341	76	2,364
Vadagarai	12,500	3,487	5,917	3,096
Kalakad	7,590	932	3,664	2,994
Malayadipudur	5,000	186	2,797	2,017
Parivarisurian	7,975	2,641	3,770	1,564
Nambikoil	3,560	...	2,769	791
Mudalurappan	5,260	...	5,209	51
Total ...	44,666	7,587	24,202	12,877
Srivaikuntam Range—				
Vallanad	2,150	498	...	1,652
Manakkarai	2,937	...	...	2,937
Total ...	5,087	498	...	4,589

85. *Grazing incidence.*—The total effective grazing area in each range, and the average incidence for each range as calculated from the average grazing revenue for the decennium 1923–24 to 1932–33 are given below :—

Range.	Effective grazing.	Average annual grazing revenue.	Incidence in acres per cow unit.
	ACS.	RS. A. P.	ACS.
Srivilliputtur	19,057	3,145 3 0	3·06
Kuttalam	10,633	2,341 7 0	2·27
Ambasamudram	19,622	1,423 0 0	6·89
Nanguneri	12,877	2,175 6 0	2·95
Srivaikuntam	4,589	636 10 0	3·60

The effect of the closure of grazing compartments owing to fire has not been considered in the above statement. This would further increase the incidence. It will be noticed that the incidence varies from 2·27 to 6·89 acres per cow unit, the average for the division being 3·43 acres per cow unit, which is undoubtedly high from the point of view of conservation and the development of the fuel and small timber resources of the division. The Forest Officer, interested as he is in these two objects, should view the decline in the grazing revenue with perfect equanimity provided it is not due to slackness or venality on the part of subordinates; a reduction in the grazing incidence would considerably enhance the future value, both direct and indirect of the forests, and ultimately be of great benefit to the ryot. The raising of the grazing fees would result in such a reduction in a much shorter time, but is not advocated, as it would contribute towards increasing the prevailing agrarian distress, besides being opposed to the declared policy of Government. The distribution of the incidence more evenly over the effective grazing area is however desirable, and to attain this object, penning, under suitable safeguards against fire, in such of the hill grazing compartments as are in demand, will be prescribed.

86. *Stall feeding of cattle.*—The practice of feeding cattle with cut fodder from the reserves is practically unknown in the division save in times of scarcity of famine. Neither the inferior breed of cattle raised, nor the resources of the ryot, would justify expenditure on stall feeding. It is only the plough bull which is stall fed at present, the vast majority of the cattle being left to eke out a precarious living from the limited village grazing grounds, the unassessed waste lands, dry tank beds and other places where grazing is free. Such of the cattle as go to the reserves cannot benefit very much from their excursion. They are driven to the forest, 2-5 miles away from the village, so as to reach it at about midday and after a couple of hours grazing or so, during the hottest part of the day, are driven back to the village for watering in the evening. The result is that while the cattle get plenty of exercise they get little nutrition, and their manure is definitely lost to the fields. With a view to encourage stall feeding it appears desirable to permit the free removal of fodder grass (at present an item of minor forest produce) under adequate control.

87. *Improvement of fodder grass.*—The important question of improving the fodder grass in the division has not received the attention it deserves. This is partly due to the fact that most of the more easily accessible forest on the outer slopes has been constituted into fuel felling series, and it is the policy of the department that areas set apart for the production of fuel or timber should not be utilized for the artificial propogation of grass. The Kudiraimozhi Teri Reserve is a large sandy waste, the partially reclaimed portions of which would be ideal for the experimental introduction of tropical grasses. Situated as it is close to the Tiruchendur-Palamcottah branch of the South Indian Railway, it would increase enormously in value if clothed with grass, which would not only serve the purpose of fixing the sands, but also provide grazing for local cattle and perhaps serve in time as grass farm from which grass could be annually harvested and transported for sale throughout the division. The grass *Pennisetum cenchroides* was introduced in 1932 on an area of 2 acres in the Nazareth series but the experiment was a failure, largely because the grass was sown towards the tail-end, instead of at the first burst, of the north-east monsoon. If the experiment be persevered in under better auspices there is little doubt that it would be successful. The fact that the whole of the Teri reserve is closed to grazing is an additional advantage.

88. *The grazing year.*—The grazing year is at present synonymous with the fasli year, starting from 1st July. This is because the demand for grazing begins only in July, by which time the south-west monsoon has already burst on the hills. The fallow fields and tank beds where the village cattle normally find their grazing are no longer available, as the former are under cultivation and the latter are usually filled with water. No change in the present arrangement is advocated, as it is not only long established in the division, but also is eminently suited to local conditions.

89. *Closure to grazing.*—The present policy is to close areas to grazing after bad fires, mainly to enable the damaged tree growth to recover by removing the temptation to the grazier to reburn the area. There is little doubt that the majority of the fires in grazing areas are due to the incendiary activities of graziers who attempt to destroy the tall coarse grass present in such areas by fire, in order to obtain the luscious young shoots which appear in the burnt area immediately after a little rainfall. To be of value sylviculturally and also as a deterrent measure, closure should be prompt and effectively enforced. Cattle do appreciable damage to fire coppice and seedling growth; besides they loosen the exposed soil by trampling and thus render it more liable to erosion by rain, a matter of considerable importance in this division where the bulk of the forests are situated on steep slopes. At present much delay is caused before closure can be applied as the Collector's sanction is necessary. The delay is fatal both sylviculturally and as a deterrent measure. The only way to remedy this state of affairs is to empower the District Forest Officer to order closure himself up to 1,000 acres subject to the proviso that any action taken by him be reported forthwith to the concerned Collector within ten days.

90. *Minor forest produce.*—All minor forest produce is extracted through the agency of contractors, the right to collect it being sold annually in auction by farms for the fasli year beginning 1st July. The following table contains an abstract of the total quantity in quarters, of various items extracted in the division, according to contractors' accounts, for the years 1923–24 to 1931–32. The botanical name of most of the items has been verified as far as possible, but the need for verification with botanical specimens is emphasized. The conversion factor adopted is 1 headload equals 56 lb.

English or vernacular name. (1)	Botanical name. (2)	Portion used. (3)	1923–24. (4)	1924–25. (5)	1925–26. (6)	1926–27. (7)	1927–28. (8)	1928–29. (9)	1929–30. (10)	1930–31. (11)	1931–32. (12)
1 Achanpallam	*Cudrania javanensis*	Fruit	..	..	..	8	..	..	..	..	..
2 Alangikai	*Alangium lamarckii*	Do.	6	34	..	60	..	..	..	..	..
3 Alapanni	*Arenga wightia*	Leaves and	34	..	288	42	30	5	..	30	132
		flowers.	..	..	..	98	..	1	..	..	26
4 Athikai	*Ficus sp.*	Fruit	..	..	..	..	..	4	..	..	6
5 Avaram	*Cassia auriculata*	Bark	34	808	..	..	..	232	1,150	850	1,206
6 Bees wax and honey	....	..	..	..	208	936	..	14	24	4	5
7 Boonthikottai	....	Seed	..	..	..	..	78	..	..	..	..
8 Cardamoms	*Elettaria cardamomum*	Fruit	966	282	494	256	580	371	89	141	185
9 Cashewnuts	*Anacardium occidentale*	Do.	..	..	..	..	86	6	28	114	421
10 Coconut	*Cocos nucifera*	Do.	..	..	..	..	2	28	..	..	10
11 Coffee	....	Do.	6	..	..	..	..	..	..	..	4
12 Creepers	....	..	260	2,064	1,962	1,008	2,082	1,618	1,980	758	1,276
13 Elandaikai	*Zizyphus jujuba*	Fruit	..	202	600	1,408	..	..	..	380	1,082
14 Garudakodi	....	Do.	..	..	2	40	46	..	..	382	12
15 Ginger	*Zingiber cassummunar*	Tuber	..	14	6	..	26	6	..	18	..
16 Grass (thatch)	....	..	35,350	70,096	45,796	60,356	71,160	20,880	25,639	52,459	64,515
17 Grass (fodder)	....	..	..	..	..	..	..	..	1	766	1,654
18 Gravel	....	..	..	9,080	680	..	..	..	..	13,880	12,840
19 Illupai	*Bassia latifolia*	Fruit	..	..	12	..	..	..	..	..	..
20 Indukodi	*Acacia intsia*	Bark	988	170	380	..	426	394	299	1,061	1,102
21 Indunar	*Acacia intsia*	Fibre	..	..	..	..	..	60	..	..	..
22 Inju	*Phoenix sp.*	Fruit and leaves.	..	70	158	1,284	996	144	244	256	992
23 Itakalli	*Ochlandra sp*	Seed	3,014	2,746	3,128	6,592	3,266	5,032	6,168	11,737	7,390
24 Jack	*Artocarpus integrifolia*	Fruit	66	258	..	462	1,476	245	278	278	249
25 Kadukai	*Terminalia chebula*	Do.	252	568	322	1,150	4,614	573	3,124	1,742	571
26 Kanakamugu	*Pinanga dicksonii*	Fruit and leaves.	..	..	122	240	206	47	118	87	76
27 Kanjurankottai	*Strychnos nuxvomica*	Seed	..	..	..	40	..	..	..	..	..
28 Kandapanai	*Bentinckia coddapana*	Fruit	..	..	..	..	..	..	..	..	14
29 Karuthativer	*Sida rhomboidea*	Fibre	..	..	..	..	..	..	..	..	46
30 Karuveppillai	*Murraya Kœnigii*	Leaves	1	..	130	42	6	62	..	4	27
31 Kathalai	*Agava sp.*	Fibre	..	..	..	2,822	..	2	..	80	70
32 Kattujadikai	*Myristica sp.*	Fruit	..	..	384	..	..	..	..	..	82
33 Kelakai	*Carissa carandas*	Do.	4	242	774	1,720	286	8,718	864	258	670
34 Kodivaliver	*Tinospora cardifolia*	..	..	112	142	..	60	18	192	19	238
35 Kollankorai kilangu	*Corallocarpus epigœa*	Tuber	..	..	..	..	..	..	..	4	..
36 Koovai	*Curcuma angustifolia*	Leaves	..	222	46	640	764	176	261	430	699
37 Koovaikilangu	Do.	Tuber	..	..	458	..	..	..	..	8	48
38 Kovanji	*Solanum sp.*	Fruit	..	..	..	..	..	..	..	..	1
39 Korai grass	*Cyperus rotundus*	..	166	202	518	882	408	451	264	539	737
40 Kunthrikam	*Canarium strictum*	Dammar.	378	168	384	494	536	42	138	208	22
41 Lavangapatti Shannalavangam.	*Cinnamomum gracile*	Leaves and bark.	..	40	160	112	60	22	93	8	79
42 Mangoes	*Mangifera india*	Fruit	..	54	..	2	3	..	..	..	70
43 Manjanathi	*Morinda tinctoria*	Bark	..	..	..	..	..	1	..	..	..

English or vernacular name.	Botanical name.	Portion used.	1923–24.	1924—25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30	1930–31.	1931–32.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
44 Muduchikai	*Buchanania latifolia* ..	Fruit ..	..	..	..	..	..	14	..	..	..
45 Mullikai	*Solanum indicum* ..	Do. ..	8	..	..	..	..	86	248	12	14
46 Nangu	*Messua ferrea* ..	Seed ..	..	..	..	..	..	..	18	50	80
47 Nannariver	*Hemidesmus indicus* ..	Root ..	..	..	..	4	..	..	4	..	..
48 Neikottai	*Sapindus emarginatus* ..	Fruit ..	..	..	..	12	18	..	..	..	..
49 Nellikai	*Phyllanthus emblica* ..	Do. ..	..	26	80	280	12	7	34	6	17
50 Nochi Nar	*Vitex negundo*	Fibre ..	..	..	..	..	..	..	..	..	1
51 Nongu	*Borassus flabelliformis* ..	Fruit ..	..	..	16	..	..	24	..	3	..
52 Odankodi	*Hippocrates indica* ..	Do. ..	..	..	..	..	..	..	..	250	2,398
53 Palankodi	*Toxocarpus kleinii* ..	Do. ..	..	..	..	..	..	9	8	30	18
54 Panaiolai	*Borassus flabelliformis* ..	Leaves ..	..	124	350	194	82	16	8	446	120
55 Plantain	*Musa sp.*	Do. ..	130	..	120	302	196	178	10	66	73
56 Poolathikodi ..	....	..	..	188	30	216	72	218	166	918	86
57 Pulukapattai ..	....	..	14	6	12	306	104	3	251	..	240
58 Rattan	*Calamus rotang* ..	Cane ..	2,230	860	682	1,248	1,234	668	3,914	2,521	2,777
59 Salapanaiolai ..	*Corypha umbra culifera* ..	Leaves ..	..	..	90	154	540	158	12	..	55
60 Saragapattai.. ..	*Cassia fistula*	Bark ..	..	..	..	..	..	..	..	..	10
61 Sayaver	*Oldenlandia umbellata* ..	Chay root.	..	..	12	..	..	..	..	..	..
62 Seegikai	*Acacia concinna* ..	Barb and fruit.	..	..	..	4	4	..	..	..	2
63 Selankoi	....	..	..	..	..	10	164	74	130	1	8
64 Senkottai	*Semecarpus anacardium.*	Marking nut.	..	..	..	88	..	..	..	..	..
65 Stone cut	....	..	380	41,240	2,306	10,600	1,890	4,480	11,080	48,040	32,440
66 Stone rough	....	..	94	9,960	506	3,320	3,864	4,804	15,520	5,720	8,680
67 Sundaidai	*Solanum torvum* ..	Fruit ..	138	594	1,664	416	902	1,076	1,212	799	1,351
68 Tamarind	....	Do. ..	1,722	1,946	712	1,366	2,004	323	1,002	2,905	2,433
69 Tellukoi	*Entada scandens* ..	Do. ..	..	..	126	90	210	98	226	391	51
70 Tettankottai.. ..	*Strychnos potatorum* ..	Do. ..	..	..	..	10	92	5	..	..	..
71 Thalaipu	*Pandanus sp.*	Screw pine flower.	..	..	..	..	216	94	273	213	539
72 Thanikai	*Terminalia belerica* ..	Fruit ..	..	..	..	10	108	11	..	..	..
73 Vallamburikai ..	*Helecteres isora* ..	Do. ..	..	6	284	182	164	13	56	..	..
74 Vallikilangu	*Ipomœa digitata* ..	Tuber ..	..	14	10	4	..	6	..	..	..
75 Varthamkai	*Azadirachta indica* ..	Fruit ..	..	..	..	..	..	1	..	..	..
76 Vembadam	*Ventilago madraspatana.*	Bark ..	14	..	50	12	114	52	..	45	5
77 Vilankai	*Feronia elephantum* ..	Fruit ..	..	..	..	..	..	1	..	..	..

In addition to the list of products, enumerated above, the following items which find a place in the existing schedule of minor forest produce, but which do not appear to have been collected, may be included :—

(1) Kalmadam : *Buchanania sp.* (probably).
(2) Nervalam : *Croton tiglium.*
(3) Puvan seed : *Schleichera trijuga.*
(4) Oranges, lemons and pumiloes : Found in rest-house compounds.
(5) Guavas : Found in rest-house compounds.
(6) Punnamkottai : *Calophyllum inophyllum* seeds.
(7) Seenthi kodi : *Acacia pennata.*
(8) Kalpasi : *Stonemoss.*
(9) Vilvamkai : *Aegle marmelos.*
(10) Kullaipattai : *Grewia sp.* bark.

The inclusion of the shed horns of sambhur and cheetal stags, at present an item in the schedule, is not advocated as the Collectors frequently set fire to grass areas in order to find the horns more easily. In this division where game is comparatively scarce, the revenue sacrificed will not be incommensurate with the risk to the forest involved.

The prevailing system of dividing the ranges into farms bounded by natural features has much to recommend it, as small contractors are encouraged to bid at the sales and competition is stimulated. The prices obtained at the sales are usually fair as competition is keen and the system of sales long established. Therefore departmental collection is not recommended save in exceptional circumstances, e.g., where prices obtained at the sales for a particular product which can be easily collected, such as tamarind, are wholly incommensurate with the value of the produce as judged by previous year's prices and the current year's expectation of the crop.

SECTION 2.—MARKETS.

91. *Fuel and small timber.*—All the fuel and small timber produced in the Nanguneri and Ambasamudram Ranges is disposed of locally, the small timber being absorbed mainly by the rural and village population and the better fuel being sent to the big towns such as Tinnevelly and Palamcottah. The abolition of tolls on cart-traffic has given a great impetus to this method of fuel transport, which is now cheaper for distances below 30 miles than rail traffic. About 25 per cent of the fuel, charcoal and small timber produced in the Kuttalam and Srivilliputtur Ranges is sent to Madura for sale, the difference between the sale prices at this town and those prevailing locally more than covering the additional cost of transport.

92. *Evergreen timber.*—The big timber produced in the division is all evergreen timber. The difficulty of the terrain, the comparatively low value of this timber, the need for light extraction in order to preserve the essential character of these forests, have all contributed towards rendering expenditure on metalled roads unjustifiable. It is not possible therefore to extract logs, and only scantlings, such as boles 16 feet by 6 inches by 4 inches and half boles, kais 18 feet by 5 inches by 2 inches and half kais, and similar sizes, can be extracted, the timber being manhandled from stump site to road head, a distance which may be anything up to two miles. Most of the local demand for these scantlings is at present met from the Travancore State forests. It is with the idea of capturing a large portion of this trade and incidentally making the division self-supporting in respect of this produce, that the working of the evergreen forests is recommended.

93. *Sandal.*—All the sandal produced in the division is sent annually to the Tirupattur sale depot for sale. The need for meeting the local demand by establishing sale depots at all range offices and the District Forest office at Tinnevelly is emphasized.

94. *Minor forest produce.*—The minor forest produce collected in the division is all absorbed locally none of it as far as enquiries go, being exported.

95. *General.*—It will be noted that the division is at present far from self-supporting as far as the demand for forest produce is concerned. Prices are controlled by outside agencies, timber prices by the output of the Travancore State forests and the imports at Tuticorin; fuel prices, more or less, by the area exploited annually by the various

zamindaries and temple lands, scattered over the division. The zamindaries are particularly capricious in their annual yields, as felling is regulated not on the principle of a sustained yield but according to the present needs of each zamindar.

96. *Markets.*—The chief local markets for forest produce are—

Nanguneri Range—

Tinnevelly.	Tuticorin.
Palamcottah.	Shermadevi.
Srivaikuntam.	Nanguneri and Kalakad.
Tiruchendur.	

Ambasamudram Range—

Ambasamudram.	Kallidaikurichi.

Kuttalam Range—

Tenkasi.	Vasudevanallur.
Kadayanallur.	Sankarankoil.

Srivilliputtur Range—

Srivilliputtur.	Sattur.
Rajapalayam.	Watrap.

The only foreign market is Madura, which absorbs about 25 per cent of the outturn of fuel and small timber of the coupes in Kuttalam and Srivilliputtur Ranges.

SECTION 3.—LINES OF EXPORT.

97. *General.*—Both the Tinnevelly and Ramnad districts are supplied with an excellent net work of roads maintained by the respective district, taluk board and municipal authorities. Most of the roads in Tinnevelly district are so well maintained, as compared with those in the Ramnad district, that the motorist knows without being told that he has crossed the Tinnevelly-Ramnad frontier. This road system is reinforced by the following metre gauge railway lines of the South Indian Railway :—

(1) The Virudunagar-Tenkasi chord line, connecting the forests of Srivilliputtur and Kuttalam, with the big towns of the North Tinnevelly and Ramnad plains, and with Madura.

(2) The Tuticorin-Maniyachi branch line, connecting with the port of Tuticorin.

(3) The Tinnevelly-Tiruchendur branch line.

(4) The Tinnevelly-Virudunagar line.

(5) The Tinnevelly-Ambasamudram-Tenkasi line: available for the forests of Ambasamudram and Nanguneri Ranges.

98. *Forest roads.*—Forest produce is usually transported from the forest along rough fair weather cart-tracks, to the main public roads and thence either by road or rail to the important markets. The only metalled forest roads in the division are the Mundanthorai-Papanasam ghat road, $4\frac{1}{2}$ miles, and the road connecting Kalakad village with Sivanaperi rest-house, about half mile. Since most of the fuel series are in their second rotation, and some in their third, expenditure on cart-tracks in a fuel coupe is restricted to the re-opening of such tracks as were used in the previous rotation. This comparatively small expenditure is cheerfully borne by the coupe contractor, who, it must be acknowledged, does the work far more cheaply and expeditiously than it could be done departmentally. Too little attention, however, has been paid in recent years, to the important point of assisting the contractor to bring his produce out of the forest. The excuse has been retrenchment, but it is no real economy, rather the reverse indeed, to allow our roads to get into disrepair, as not only will the subsequent cost of repairs be greatly increased, but the prices paid for forest produce will be correspondingly reduced. It also frequently happens that forest produce has to be conveyed from a particular coupe where the only road available belongs to a pattadar. The latter is usually reasonable, and some amicable settlement between the pattadar and contractor can be arrived at to the benefit of both parties. The pattadar however is sometimes unreasonable in his demands with the result that the contractor suffers loss and becomes increasingly reluctant to purchase such coupes. It is therefore to our benefit to arrange the details of extraction from every coupe, well in advance of the sales, and also to inform intending bidders at the time of sales what arrangements have been made to facilitate extraction. In case the pattadar proves recalcitrant, the Range Officer has only to make a show of starting land acquisition proceedings, to bring him to reason. The acquisition of every such cart-track under the Land Acquisition Act is not advocated, as some roads are useful only for one or two coupes and are therefore likely to be used only once or twice in a thirty-year rotation. The cost of acquisition would thus be wholly incommensurate with their value to us. Such roads as are likely to be of benefit for the working of a series of coupes however should be acquired, if other methods of bringing the pattadar to reason fail.

99. *The Serviar and Kariar crossings.*—The Papanasam-Kannikatty road crosses two unbridged rivers one at Mundanthorai—the Serviar and the other four and a half miles away—the Kariar. The existence of these two crossings over rivers which are very turbulent during the monsoons, considerably detracts from the value of the road, and the question of bridging either or both rivers has engaged the attention of almost every Forest Officer, who has been in charge of the division, since the working of the coppice coupes on the Mundanthorai plateau was firmly established. The project was examined by Mr. F. A. Lodge as early as 1905 and an estimate for Rs. 15,000 for the Serviar bridge prepared, it being found that even with the limited working then prevalent the bridge would pay handsomely for itself. In 1919 Mr. P. M. Lushington resuscitated the subject and believed that a bridge across the Serviar would cost at least Rs. 30,000 but was even more imperatively necessary then, to enable the successful working of the evergreen forests in Ambasamudram Range for fuel and timber, a project in which he was greatly interested. No real progress was however made till Mr. R. D. Richmond's visit to the division in 1932 when the investigation of the project by the Forest Engineer was ordered. The latter submitted an estimate for a three-span steel girder bridge across the Serviar at Mundanthorai for Rs. 27,100.

100. *Advantages of the project.*—The financial implications of the project may now be examined :—

(*a*) On the right bank of the Serviar we have the Padaramalai Fuel Series, the Kodamadi evergreen timber coupes, the Kariar and Kodamadi teak plantations, and the Kannikatty evergreen timber coupes, all of which would benefit from the construction of a bridge across the Serviar. The annual coupe in the Padaramalai Series is about 130 acres, and it now sells at Rs. 16 per acre though inferior coupes on the left bank of the river in the Koilteri series fetch Rs. 30 to Rs. 35 per acre. At a conservative estimate the bridge at Mundanthorai would result in an increase in revenue of Rs. 15 per acre or Rs. 1,950 per annum.

(*b*) The evergreen timber coupe of about 225 acres will be situated on the right bank of the Serviar for eight out of the ten years of the felling cycle. The annual yield will be in the vicinity of 30,000 cubic feet and if the increased transport facilities afforded by the bridge result in a saving on carting of 1 anna a cubic foot, an annual saving of about Rs. 2,000 would result.

(*c*) A greater revenue (difficult to forecast) for our teak regeneration areas at Kariar and the thinnings of teak plantations at Kariar and Kodamadi, would be obtained.

(*d*) The Kattalaimalai Estate would benefit considerably from the project and would in all probability consent to an enhancement of its annual contribution or to share the original cost.

101. *Disadvantages of the project.*—The following points however need careful consideration :—

(*a*) The Serviar is subject to sudden and violent floods, during which whole trees are washed down and this would be a serious menace to any bridge unless it had very high arches and a long span. The Kariar is even more turbulent in this respect and has changed its course at least twice in the last decennium, to the knowledge of the present generation.

(*b*) In case the Papanasam Hydro-electric Scheme adverted to in paragraph 82 above materializes the Mundanthorai bungalow as well as the proposed bridge site would be completely submerged. To risk a large capital expenditure on the project does not seem advisable.

102. *Conclusions.*—For these reasons the construction of stone causeways across both rivers is recommended. The expenditure on them would be considerably less and therefore the project could be financially better justified. Both rivers contain high water for only two or three months in the year during which practically no carting is done, as the fair-weather roads are not negotiable owing to the heavy rainfall. All that the cartmen desire is a surface, even enough to provide foot hold for their bulls, and grip for the cart wheels. A foot or so of water running over the causeway would not render it impassable. An investigation into the possibilities of constructing such causeways is of the greatest importance from the point of view of obtaining a fair price for all our produce on the right bank of the Serviar. Besides any one who has seen the distressing sight of bullocks struggling across the river with loaded carts, at Mundanthorai would be

tempted to promote the scheme on humanitarian principles alone. The construction of the causeway across the Serviar at Mundanthorai in Tinnevelly division has since been sanctioned by the Chief Conservator and the construction across the Kariar by the Conservator. The former has been completed and the latter is in progress.

103. *Inspection paths in the shola forests.*—The need for opening up the evergreen shola areas at Kannikatty and Kodamadi was recognized in 1929, when a scheme for supplying the war-devastated areas in France with cheap timber was being organized by Mr. A. W. Lushington. About 75 miles of inspection paths (45 miles in Kodamadi and 30 miles in Kannikatty), were constructed at a cost of Rs. 1,118–9–0 in order to assist in the preparation of rough stock maps of an area of about 75 square miles. As the scheme was given up, these paths were mostly abandoned with the result that many of them were obliterated either by the all-pervading reed jungle or by evergreen growth. Such of the paths as lead to the various rest-houses in these areas are being maintained, while others used frequently by elephants, provide at present the only means by which the interior of the forests can be inspected.

SECTION 4.—METHODS OF EXPLOITATION AND THEIR COSTS.

104. *Fuel and small timber.*—All fuel and small timber is extracted through the agency of contractors. The method of working and the rates vary from place to place, according to tradition, availability of labour and the demand for the produce. The following methods are in vogue :—

(*a*) On the receipt of the licence the contractor first proceeds to clear all undergrowth, and fell and coppice all tree growth except standards and reserved trees flush with the ground. This work is all done on contract by one set of axemen at a rate varying from Rs. 8 to Rs. 12 per acre according to the proximity of the coupe to village and labour, the density of the standing growth, the size of the trees and the difficulty of the terrain. Another gang of axemen converts all the fuel into billets and loads the latter into carts (where carting is possible). These are paid at the rate of 8 annas per cart-load, but this figure is increased to a maximum of 10 annas per cart-load according to the lead. All small timber is rough dressed into poles *in situ*, and loaded into carts by a third set of coolies who are paid at the rate of Rs. 1–8–0 per cart-load. Big timber, if any, is rough squared and loaded into carts at a rate of Rs. 4 per cart-load of about 20 cubic feet. In case carting is not possible the produce already felled is converted into charcoal by professional burners, who are paid at the rate of 4 annas per bag of 80–85 lbs. This system is prevalent in most of the fuel series in Kuttalam and Srivilliputtur Ranges.

(*b*) The preliminary work is the same but payment for conversion is different. In the Parivarisurian and similar poor fuel coupes of Nanguneri Range, the fuel is felled, converted and loaded into carts at a rate of Re. 1 per 100 thulams which works out at Rs. 1–9–0 per ton. Another rate paid for similar work in the better fuel series like Kalakad and Tirukurangudi, is $5\frac{1}{4}$ annas per "Thak" of about 43 stacked cubic feet ($3\frac{1}{2}$ feet by $3\frac{1}{2}$ feet by $3\frac{1}{2}$ feet), which on the assumption that 1 ton equals 128 stacked cubic feet, amounts to about Re. 1 per ton. The rate for charcoal is 9 annas per 8 thulams which amounts to $4\frac{1}{2}$ annas per bag of 80-85 lbs.

(*c*) In Ambasamudram Range the felling, trimming of stools, billeting and stacking in heaps, are all done in one operation the rate varying from 2 annas to 3 annas per idai of $\frac{1}{8}$ ton.

105. *Method of working.*—The method of extraction in the "simple coppice" coupes is that prevalent throughout the Presidency. The annual coupe is surveyed and demarcated on the ground in accordance with the working plan map and is divided according to its size into three or more strips. On receipt of his licence, the contractor is permitted to start felling in strip I, and on completion of this strip, he is allowed to commence work on strip II provided he has paid all his dues under the terms of the contract and the Range Officer has given him a clean bill for the first strip. All removals from the coupe are covered by head-load or cart-load permits issued by the contractor or his authorized agent, and a monthly return of all permits issued is sent by the contractor to the Range Officer. In the "Coppice with standard" coupes where standards are retained at an average rate of 15-20 per acre, the marking of standards is done at the time the coupe is surveyed and the contractor is given a duplicate list of standards one copy of which he signs and returns to the District Forest Officer, in token of having taken charge of the standards, for whose safety he is responsible, until the termination of his contract.

106. *Removals of fuel by head loads.*—All brushwood and such fuel of small dimensions as would be unremunerative to cart is sold by the contractor on headload permits. The number of head load permits sold annually in the division for the triennium 1930 to 1932 is given below :—

Year.	Name of Range.				
	Srivilliputtur.	Nanguneri.	Ambasamudram.	Kuttalam.	Total.
1930 ...	32,960	29,091	41,290	65,326	168,667
1931 ...	31,716	26,536	33,175	69,648	161,075
1932 ...	41,484	33,547	34,061	75,710	184,802

The fuel is collected thus mostly by women both for household use and for sale in neighbouring villages, and the trade forms a valuable means of supplementing agricultural income especially in the off-agricultural season. It will be observed that on an average 171,515 people visit the fuel coupes annually; it is not surprising that utilization of the produce is very complete, there being, beside thorns, little or nothing left in the coupe which would be useful for burning prior to artificial regeneration. With a view to assist regeneration operations and also to control removals from the coupes, it has been suggested that the contractor should be compelled to retain all brushwood below a minimum girth of 3 inches in the coupe, and to stack small fuel above 3 inches girth in the coupe, so that such stacks could be measured departmentally and the contractor compelled to issue only as many headload tickets as would cover the produce in his coupe. At present headload tickets are issued by the contractor as a matter of routine and there is a suspicion that removals are effected not only from the coupe but also from other parts of the forest. The remedy advanced above would improve matters and help regeneration operations, but it is open to serious objections. Firstly a large number of people who rely on this trade for their livelihood would be adversely affected and illicit removals would probably be considerably aggravated. Secondly the imposition of a girth limit on removals is bound to serve as a powerful handle in the hands of unscrupulous subordinates for petty oppression and corruption. Thirdly the compulsion on the contractor to stack his brushwood before sale would mean an increase in extraction costs which would undoubtedly affect our sale prices adversely. Fourthly the difficulty of enforcing a girth limit on removals, on an illiterate populace, should be considered. Fifthly it is the fuel below 4 inches girth which is most valuable to the palmyra sap boiling industry. Finally the ryot has learnt by long usage to go to the fuel coupes for his requirements and this is borne out by the frequently observed fact that where a fuel coupe is reasonably close to a village, illicit removals in the surrounding forest are rare. For these reasons the abovementioned restriction on such removals is not advocated.

107. *Timber.*—Evergreen shola timber is the only timber extracted in the division. Situated as the shola forests are, comparatively remote from human habitations, in localities which besides having a high rainfall and being infested with millions of leeches, are frequently malarious, it is only to be expected that exploitation is both difficult and expensive. For purposes of comparison the rates paid at Kannikatti under departmental working during 1929 to 1931, and extraction through the agency of contractors in 1932 and 1933 are set out below :—

Units.	Measurement.	Cubic contents.	Departmental rates. Coupe I, 1929. (Cost. Per unit.)	Departmental rates. Coupe II, 1930. (Cost. Per unit.)	Contractor's rates. Coupe III, 1931.	Contractor's rates. Kodamadi, 1932.	Contractor's rates. Kannikatti, 1933.	Remarks.
			RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	
1 B.G. Sleeper ..	9′ × 10″ × 5″	3·12	4 9 9	3 10 6	3 8 0	..	3 6 0	Mesua ferrea only.
2 M.G. Sleeper ..	6′ × 8″ × 4½″	1·50	2 7 0	1 13 3	1 12 0	..	1 15 0	Do.
3 Full boles	16′ × 6″ × 4″	2·66	2 6 6	2 0 6	2 0 6	1 14 0	1 10 6	
4 Three-fourths boles.	12′ × 6″ × 4″	2·00	1 13 0	1 8 3	1 8 3	1 6 6	..	
5 Half boles	8′ × 6″ × 4″	1·33	1 3 3	1 0 3	1 0 3	0 15 0	..	
6 Full kais	18′ × 5″ × 2″	1·25	1 1 0	1 0 3	1 0 6	0 15 0	0 15 6	
7 Three-fourths kais.	13½′ × 5″ × 2″	0·94	9 12 6	0 11 9	0 11 6	0 11 3	..	
8 Half kais	9′ × 5″ × 2″	0·62	0 8 6	0 8 6	0 8 0	0 7 6	..	
9 Chattam	9′ × 10″ × 2″	1·25	..	0 15 9	..	..	0 14 3	
10 Planks	8′ × 1″ × 2″	1·33	1 4 3	1 4 3	1 5 4	..	..	Artocarpus hirsuta only.
11 Do.	6′ × 1″ × 2″	1·00	1 1 0	1 1 0	1 0 0	..	..	Do.
12 Do.	12′ × 18″ × 1½″	2·25	..	..	..	1 14 0	1 14 0	Cedrela toona.
13 Vandipoles ..	....	2·22	2 0 3	..	..	..	..	Gluta travancorica only.
14 Double yerkal ..	9′ × 1″ × 4·3″	1·61	1 11 0	..	..	..	..	Mesua ferrea only.
15 Araikal	Set of 24	5·25	4 2 0	..	..	..	4 4 0	Aglaia roxbusghiana
16 Kattai	9′ × 5″ × 3″	0·94	..	..	..	0 12 0	..	only.
17 Do.	9′ × ″6 × 3″	1·12	..	..	..	1 2 0	..	
18 Scantlings	16′ × ″5 × 2″	1·11	1 1 5	..	..	..	..	
19 Do ..	12′ × 5″ × 2″	0·83	0 13 1	..	..	..	..	
20 Do. ..	8′ × 5″ × 2″	0·55	0 8 10	..	..	..	..	

N.B.—The rate for conversion of Mesua ferrea timber is 25 per cent higher as the timber is harder and badly riddled with borer holes.

108. *Method of working.*—Since there has been a widespread belief among Forest officers with local knowledge that not more than 10,000 cubic feet of shola timber can be absorbed by the local markets, extraction has been limited in the past to an area which would yield this amount of timber. The annual coupe seems to have been selected largely according to the caprice of the marking officer as a scrutiny of the 4 inches to 1-mile scale maps will show. Not more than an average of 3 trees per acre are marked as it is realized that more intensive felling is detrimental to the preservation of the essential character of this particular type of forest. Subject to this restriction trees of all exploitable species above a fixed girth limit which varies for each species and has been fixed empirically, are marked serially, with tar numbers at the base of the tree and at breast height, a marking list showing the species, girth at breast height, merchantable bole, and estimated gross volume being prepared. The trees are then put up for sale standing.

109. *System of sale.*—The first timber coupes in 1932 and 1933 were put up for sale on the system that the contractor made a lump sum bid for all the trees in the coupe. In 1933 as the bids were unsatisfactory, largely on account of the prevailing trade depression sales were by marked trees. This proved only slightly more advantageous. In the selling and buying of such forest produce it is difficult to establish a completely secure basis, owing to the large element of uncertainty as to the real value of the material put up for sale. Without some form of guarantee, purchasers are ignorant of this value, and have to rely on a marking list, which may, and frequently does, give a wrong idea of the possible outturn. The *guarantee* system of sale obviates these defects and is recommended for future adoption. Under this system, the District Forest Officer has to estimate the net outturn in cubic feet which can be obtained from a coupe, and the theory of the method of sale is that the bid is based on this estimate, which is made public to the bidders at the time of sale. The estimate is fixed on the low side to encourage the contractor to closure utilization. If the actual outturn of the coupe is less than the estimate, the contractor is refunded a proportionate amount of his bid provided that the District Officer is satisfied that the coupe has been properly worked. If the outturn is more than the estimate the contractor benefits, and the department can safeguard its interests in succeeding years as completer statistics of outturn become available. This system affects conditions of sale in two ways. The penalty for over-estimating the value of the produce sold is laid on the vendor and not on the vendee. If the latter chooses to ignore the guarantee he has only himself to blame. It also discourages gambling or at least removes all grounds of excuse for the gambler. Introducing as we are a new and yet untried system of working in our evergreen forests, it behoves us to protect the interests of intending purchasers, as it is only thus that departmental in the division during years for which reliable data is available :—

110. *Sandal.*—All sandal is now extracted under the prevailing sandalwood extraction rules and is sent after final cleaning to Tiruppattur depot, East Vellore Division, for classification and sale. The following table shows the net value of the sandal extracted in the division during years for which reliable data is available.

Year.	Cost of extraction per quarter.	Revenue realized per quarter.	Net profit per quarter.
	RS. A. P.	RS. A. P.	RS. A. P.
1923–24	1 12 5	13 1 10	11 5 5
1924–25	1 5 10	17 11 6	16 5 8
1925–26	1 8 0	...	...
1926–27	2 0 2	15 5 5	13 5 3
1927–28	1 7 10	17 1 6	15 9 8
1928–29	1 8 0	17 12 4	16 4 4
1929–30	0 15 4	16 6 3	15 6 11
1930 31	1 0 8	9 15 4	8 14 8
1931–32	1 1 4	11 0 7	9 15 3
1932–33	0 14 11	...	...

SECTION 5.—PAST AND CURRENT PRICES.

111. *Fuel coupes.*—Practically all exploitation in the division consists in selling the standing crop in the forest to contractors in public auction; departmental working of fuel coupes in the past proved much less profitable and a change in the system of working is not advocated. The prices paid by contractors for the fuel coupes have varied in the last five years from Rs. 11 per acre in the worst areas such as Ambur Felling Series, to

Rs. 70 per acre in the best, such as Kalakad Felling Series. Full details are given in Appendix IV where a tabular statement showing prices obtained for all fuel coupes from 1903 to 1932 is given. There is a marked improvement in the prices obtained for the same coupe in the second rotation in some cases, while in others there is a small decline. This cannot however be taken as an indication that the growth in the second rotation is better than in the first, as the question is complicated by supply and demand, as well as by trade conditions.

112. *Evergreen timber.*—The following statement shows the prices obtained for the various units from 1929 to 1931 during the period departmental working was undertaken :—

Name of unit.	Cubic contents.	Cost of extraction.	Retail price per unit.	Wholesale price per unit.	Net profit per cubic foot.
		RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1 B.G. Sleepers	3·12	3 8 0	...	6 0 0	0 12 9
2 M.G. Sleepers	1·50	1 12 0	...	3 0 0	0 13 4
3 Full boles	2·66	2 0 6	3 14 0	2 13 4	0 4 10
4 Three-fourths boles ...	2·00	1 8 3	2 14 6	2 2 0	0 4 10
5 Half boles	1·33	1 0 3	1 10 6	1 6 8	0 4 10
6 Full kais	1·25	1 0 6	1 10 3	1 5 3	0 3 10
7 Three-fourths	0·94	0 11 6	1 3 6	0 14 8	0 3 4
8 Half kais	0·62	0 8 0	0 12 9	0 10 7	0 4 1
9 Chattams	1·25	0 15 9	2 6 0	2 6 0	1 1 10
10 Planks	1·33	1 5 4	...	1 8 3	0 2 2
11 Do.	1·00	1 0 0	...	1 1 10	0 1 10
12 Vandipoles	2·22	2 0 3	3 9 0	2 5 8	0 3 0
13 Double yerkal	1·61	1 11 0	...	1 12 0	0 0 7
14 Arekal	5·25	4 2 0	...	5 0 0	0 2 8
15 Scantlings	1·11	1 1 5	...	1 2 10	0 1 3
16 Do.	0·83	0 13 1	...	0 14 1	0 1 2
17 Do.	0·55	0 8 10	...	0 9 4	0 0 11

The net profit per cubic foot has been calculated on wholesale prices as most of the output was sold at these rates.

The following table gives details of prices obtained for standing trees in the evergreen timber coupes sold to contractors during 1932 and 1933. For purposes of comparison the net average profit per tree under departmental working from 1929 to 1931 is also included.

Year of working.	Locality.	Number of trees.	Net revenue obtained.	Average revenue per tree.
			RS.	RS. A. P.
1929–31	Kannikatti	311	3,954	12 11 5
1932	Do.	151	800	5 4 9
	Kodamadi	159	1,300	8 2 10
	Sengalteri	100	725	7 4 0
1933	**Kannikatti**	138	862¼	**6 4 0**

CHAPTER IV.—STAFF AND LABOUR SUPPLY.

SECTION 1.—STAFF.

113. *Present staff.*—The District Forest Office and Range establishments as they stand at present are shown in the following statement :—

Name of establishment.	Gazetted officers.	Rangers.	Foresters.	Forest guards.	Reserve watchers.	Clerks.	Peons.	Bungalow watchers.
District Forest Office	1	...	...	...	...	8	4	1
Srivilliputtur Range	...	1	2	10	10	1	1	...
Kuttalam Range	...	1	2	14	14	2	1	1
Kodamadi Range	...	1	2	10	9	1	1	...
Kannikatti Range	...	1	2	5	4	1	1	2
Nanguneri Range	...	1	1	11	11	1	1	1
Srivaikuntam Range	...	1	...	5	5	1	1	...
Total ...	1	6	9	55	53	15	10	5

114. *Rangers.*—In the reconnaissance report preliminary to this working plan the allocation of rangers in the division was criticized on the following grounds:—

(1) The division of the old Ambasamudram range into the present Kannikatti and Kodamadi ranges was proposed in 1921 by Mr. H. F. A. Wood as a preliminary to the intensive working of the evergreen forests in these ranges. Inspection paths, inspection sheds and coolie lines had to be built, stock maps of exploitable areas had to be prepared, and the question of establishing a sufficiency of regeneration in advance of the removal of mature timber had to be tackled. There was thus ample justification *at the time* for reducing the size of a ranger's charge, especially as our knowledge of the evergreens was extremely limited, and the silvicultural work required the personal supervision of an officer of at least the ranger's cadre. Closer investigations, however, soon proved that our evergreen forests were not the gold mines they were thought to be, and hence the original programme of work was considerably restricted, thus removing all justification for the maintenance of two ranges. Further arguments in favour of amalgamation are—

(*a*) The Kannikatti Ranger has his headquarters at Ambasamudram on the plains. As he has no subordinates on the plains, he is compelled either to send his subordinates down from the hills whenever he requires labour for works and to carry tapals, or to rely on the co-operation of the subordinates of the Kodamadi range which frequently is not forthcoming.

(*b*) The lines of separation between the two ranges as at present constituted are very artificial, portions of the Padaramalai Felling Series in Kannikatti range projecting into Kodamadi range.

(*c*) The Kannikatti ranger has at present one fuel coupe, one evergreen timber coupe (both worked by contractors), one teak plantation of about 10 acres and 10½ miles of fair weather road to maintain annually. There is practically no protection work as the whole of the range is remote from human habitations. This hardly constitutes sufficient work for a separate ranger.

The amalgamation of the Kannikatti and Kodamadi ranges to reform the old Ambusamudram range is thus indicated. It may be necessary to give this ranger a junior as assistant in the unlikely event of our having to work the evergreen timber coupe departmentally in any year.

(2) The present Srivaikuntam range was created in 1925 with the object of accelerating the work of palmyra planting in the Kudiraimozhi Teri reserve. At present the work in the range consists of—

(*a*) The protection of the Kudiraimozhi Teri and Vallanad reserves, an aggregate area of only 16,000 acres, 11,000 acres of which consist of sand dunes sparsely afforested principally by the palmyra.

(*b*) The working of one "Simple Coppice" felling series in the Vallanad reserve, the annual coupe being about 60 acres in extent.

(*c*) The planting of some 250 acres in the Teri reserve with palmyras. This area is further proposed to be reduced to 100 acres annually for reasons detailed in paragraph 518.

The quantity of work is therefore insufficient to justify the employment of a separate ranger. It is therefore proposed to amalgamate this range with the present Nanguneri range as was formerly the case and proposals to this effect are laid down in paragraph 552, Part II.

The present headquarters of the Nanguneri ranger are at Sivanaperi; it is strongly recommended that they be shifted to Nanguneri for the following reasons:—

(*a*) Nanguneri is the headquarters of the Sub-Magistrate, Tahsildar and Sub-Treasury Officer with all of whom it is desirable that the Range Officer should be in close touch.

(*b*) Nanguneri is more centrally situated than Sivanaperi for the new combined range which will include the present Srivaikuntam range, as it is 8 miles nearer to Nazareth in the Kudiraimozhi Teri reserve, and what is more important is connected with Nazareth by regular combined bus and train services.

(*c*) Nanguneri unlike Sivanaperi has a Government hospital with a Civil Surgeon in charge.

(*d*) Nanguneri unlike Sivanaperi is situated on the main Travancore-Palamcottah trunk road and the postal service is accordingly much quicker.

(*e*) Nanguneri unlike Sivanaperi has a telegraph office.

115. *Foresters.*—The sanctioned strength of foresters for all the ranges as they stand at present is adequate. With the abolition of the Srivaikuntam range however an additional Senior Forester will be necessary in the new Nanguneri range to supervise the work in, and for the protection of, the Kudiraimozhi Teri and Vallanad reserves.

116. *Forest guards.*—The existing distribution of beats in each range is as follows :—

Srivilliputtur Range.

Name of beat.	Headquarters.
1 Khansahibpuram	Khansahibpuram.
2 Pudupatti	Pudupatti.
3 Rengarkoil North	Srivilliputtur.
4 Rengarkoil South	Do.
5 Athithondu North	Mudaliaruthu.
6 Athithondu South	Athithondu.
7 Valaikulam	Do.
8 Ayyanarkoil North	Mudangiar.
9 Ayyanarkoil South	Do.
10 Kunnur	Kunnur.

Kuttalam Range.

Name of beat.	Headquarters.
11 Vasudevanallur North	Narayanapuram.
12 Vasudevanallur South	Do.
13 Karuppasamikoil	Chellapuli.
14 Puliangudi	Melapuliangudi.
15 Krishnapuram North	Chokkampatti.
16 Krishnapuram South	Kongankulam.
17 Kadayanallur	Kadayanallur.
18 Vadagarai Kilpidagai	Vadagarai Kilpidagai
19 Chinnakadu	Kasidarmam.
20 Panpuli	Panpuli.
21 Vallam	Vallam.
22 Kuttalam West	Kuttalam.
23 Kuttalam East	Kudiyiruppu.
24 Madalamparai	Madalamparai.

Ambasamudram (Kannikatti and Kodamadi) Range.

Name of beat.	Headquarters.
25 Kadayam North	Mettur.
26 Kadayam South	Govindaperi.
27 Sivasalem	Sivasalem.
28 Ambur	Do.
29 Koraiyar	Papanasam.
30 Aladiyur	Do.
31 Koilteri	Pechiammiankoil.
32 Kuduvarai	Kodamadi.
33 Kodamadi	Do.
34 Padaramalai	Mundanthorai.
35 Kariar	Do.
36 Ullar	Kannikatti.
37 Kannikatti	Do.

Nanguneri (Nanguneri and Srivaikuntam) Range.

Name of beat.	Headquarters.
38 Kolundamamalai	Sermadevi.
39 Terkuviravanallur	Pudukudi.
40 Vadagarai East	Padmaneri.
41 Vadagarai South	Sivanaperi.
42 Kalakad	Do.
43 Malayadipudur North	Do.
44 Malayadipudur South	Nambikoil.
45 Sengalteri	Kuvapatti.
46 Parivirisuriyan North	Tirukurangudi
47 Parivirisuriyan South	Do.
48 Tirukurangudi	Nambikoil.
49 Teri North	Nazareth.
50 Teri South	Neivalai.
51 Kanam	Kanam.
52 Vallanad	Vallanad.
53 Manakarai	Alvarkulam.

The above distribution has been examined with a view to discovering whether each beat guard is adequately employed throughout the year. As a result of this examination it was found necessary to reduce the size of beats which were found to be too large and increase the size of beats wherever the work was found to be inadequate. The division has accordingly been divided into 51 beats the limits of each beat being marked on the working plan maps. The proposed list of beats is given in paragraph 551, Part II. In addition the two forest guards now employed on special duty in connexion with evergreen timber extraction and regeneration, and teak plantation work in the Ambasamudram range will continue to be required.

117. *Office establishments.*—The state of the District Forest Office of recent years has been a cause of complaint to most incoming District Forest Officers. An examination of the distribution of work has shown that the office is understaffed. With a view to a more equitable distribution of work and in order to cope with the increased work involved in the maintenance of control records prescribed under this working plan, an extra clerk is an urgent necessity.

The work in Kuttalam range does not justify the retention of two range clerks. One of them can, therefore, be transferred to the District Forest Office. With the amalgamation of the present Kannikatti and Kodamadi ranges, the existing two range clerks will be required for the new Ambasamudram range as there will be ample employment for both.

The amalgamation of the present Nanguneri and Srivaikuntam ranges will probably also result in an increase of office work which may necessitate the employment of both the present clerks. Provision will accordingly be made, but both clerks will not be employed unless it is found by experience that one is insufficient. Changes in the office establishment will be prescribed on the above lines.

118. *Permit-issuing officers.*—It has been customary in the past to employ permit-issuing officers for the collection of grazing and manure leaf revenue, these officers being paid a commission of $6\frac{1}{4}$ per cent on the revenue collected. In 1931–32, it was ordered as a measure of retrenchment that this revenue be collected by the range officers themselves, selected foresters being also especially empowered to do so. The system of departmental collection of revenue while undoubtedly saving the commission to permit-issuing officers, is open to serious objections. Firstly to have the same machinery both for issuing the permits and for checking them is objectionable as it gives ideal opportunities for illicit gain, and check is bound to be perfunctory, it being to the interest of the checking officer, usually a beat guard, to be lax in his work in order to cover up any deficiencies in the issue of permits by the issuing officer, who is usually his superior. Secondly, for the purpose of collecting the full revenue the forester or range officer is compelled to visit the ryot in his village at a time when the latter has money and persuade him to take out permits. This frequently exposes this class of officer to ridicule and sometimes to open abuse. It is not consistent with the dignity of his office, that he should be open to such treatment. Again, the purchase of grazing permits from permit-issuing officers was largely effected by the ryot on the credit system. The forest officer is forbidden to allow credit officially. Finally a great deal of the time of the subordinate staff, which could be more usefully employed in regeneration and other work in the forest, tends to be wasted in ineffectual wanderings from village to village in search of likely purchasers of grazing permits. The old permit-issuing officer was usually a man with local influence and was personally interested in the collection of the grazing revenue. He not only knew all the cattle owners intimately enough to trade with them on a credit basis, but also ensured in his own interests that all cattle going to the reserves were covered by permits. He also served as a valuable check on the subordinate staff, by bringing to the notice of higher authorities any connivance on the part of subordinates with local graziers. It seems desirable, therefore, to return to the old system of permit-issuing officers, as far as the collection of grazing revenue is concerned. Their commission will be reduced from $6\frac{1}{4}$ per cent to 5 per cent.

119. *Manure leaf revenue.*—The demand for manure leaf is largely seasonal; large quantities are wanted for wet lands just before the north-east monsoon with the result that the demand is restricted to the months of September–October. This is the period when regeneration work, rab-sowings, have to be done, and neither the range officer nor his foresters can spare the time necessary for the issue of manure leaf tickets. The right to sell manure leaf tickets was put up to auction in 1922–23 in Srivilliputtur range, and fetched a handsome sum of Rs. 3,345. Why the system was abandoned is not apparent. If the removal of this produce from the forest is to be permitted at all, there is no reason why a reversion to this method of sale should not be effected. The advantages are undeniable. The contractor would be interested in obtaining the maximum revenue, and

hence would serve as a check on the work of the subordinate staff. A lot of office work in the way of preparing permit returns, etc., would be saved. The system will, therefore, be prescribed.

SECTION 2.—LABOUR.

120. *General.*—No difficulty is usually experienced in obtaining unskilled labour for departmental works such as, regeneration, fire line and coupe line clearing and road repairs. The demand for agricultural labour being seasonal unskilled labour is apt to be scarce at harvest or sowing time. The number of festivals celebrated annually by the ryots of the division, however, preclude the detention of labourers for any length of time away from their homes and is accordingly a source of annoyance to employers of labour.

121. *Hill tribes.*—The only inhabitants of the ghats are the Kanis and the Palayars. The Palayars are a malodorous and unsightly race, with short bodies, square faces, thick lips and unkempt hair. Men and women wear a small cloth or palm leaf sheath about their thighs; they scarcely even bathe and when they do, it is only (as they explain) to keep themselves cool and not clean. Their language is a corrupt form of Tamil. They live in groups of one or two families in the *pudais* or caves in the ghat forests, occasionally rigging up rough shelters of reed and leaves for comfort in the dry weather. Most of them collect minor forest produce, such as roots, honey and wax, cardamoms and dammar for the renters under the Forest department, and receive grain in payment which they cook and eat at once, with great avidity and improvidence. Otherwise their foods are generally taken raw. All told they number about 40 persons in Srivilliputtur range and about 20 individuals in the hills overlooking the Sankaranayinarkoyil taluk in Kuttalan range. A few are being utilized at present very successfully by the Srivilliputtur ranger in sandal-wood extraction work, mainly in the transport of sandalwood trees to the forest depot and in guarding the latter. They are not by nature hunters of game and are useless as trackers. They do not keep cattle or cultivate. Having exhausted the resources of a particular locality they move on to another *pudai.* Marriage ties are of the flimsiest character and promiscuous relationships common. Child birth is a simple matter and is considered not to require more than two days holiday. Old and useless people are neglected and left to die. They have no headman and every one settles his own quarrels.

122. *The Kanis.*—The Kanis are to be found in the neighbourhood of Kannikatty and in the Singampatti zamin. They are also called *malai arasans* and are supposed to be the oldest race in the division having been driven into the hills by the first invaders of the plains. They are much more civilized than the Palayars. Their settlements, called *vadis* consist of huts, made of reed, grass and small timber, and are situated strategically away from the haunts of men or animals. Surrounding these dwellings are the patches of land they cultivate. The ground is first cleared of tree growth and the felled matter well burnt. After the first shower of rain it is roughly chopped up with a bill-hook, and is ready without further tillage to be sown. Cholam, tapioca, sweet pottatoes, plantain and chillies are the usual crops and form their staple food. In addition each *vadi* is permitted by the Abkari authorities to grow five ganja plants (*Cannabis sativa*) per head. This narcotic is smoked by men, women and children, and is largely to blame for the marked deterioration of the physique of the race. When their land shows signs of exhaustion, that is, after a couple of years, they move on, if permitted, to another spot and repeat the process of clearing, burning and planting. This habit of shifting cultivation has been responsible for the destruction of the fine shola forest which at one time undoubtedly clothed the Ullar, Peyar, Upper Kariar and Serviar valleys. In the early part of the century, the Forest department decided to control their ravages by allotting them sites on the right bank of the Peyar. Most of them moved across the Tambraparni to the Singampatti zamin or over the frontier into Travancore, where they are not subject to such severe restraints. There is at present a small settlement of eight male members on the right bank of the Peyar. These men find intermittent occupation in the Kannikatty forests, in the regeneration of gaps in the evergreen timber coupes, and in the clearing of the common boundary line between Kattalaimalai estate and the Government forests. They were of great use to the working plans party, their expert identification of the commoner evergreen species, as well as their unrivalled knowledge of the forest being invaluable. Although of poor physique they make excellent forest guides and show remarkable powers of endurance. Each settlement has its hereditary headman who exacts implicit obedience and is much feared. The marriage tie is respected but divorce is permitted by mutual consent. Their language is a mixture of Tamil and Malayalam.

123. *Ponam plantations.*—Attempts have been made from time to time to divert their energy in the matter of shifting cultivation into useful channels, by giving them areas to plant up with teak in conjunction with fieldcrops. The *ponam* teak plantation of 1912 raised thus, in the Kariar valley is a fine example of what they can do under proper

control. The average costs of departmental teak plantations in this division in the past has been Rs. 40 per acre. With a view to reducing this cost considerably it seems desirable to permit the Kanis to practice *ponam* cultivation in the Clear Felling Working Circle, especially as they have recently professed a great desire to do so. They will have to be carefully watched, however, as Mr. P. M. Lushington, who had intimate dealings with them in the past, held the opinion that they were the laziest, most unreliable and mischievous of the jungle tribes he had come across. His condemnation of the tribe in an inspection note of 1915 is worth quoting, "That the Kani has been a regular curse to the district there is not a shadow of doubt. He is the one hillman who is still allowed to practice shifting cultivation. In days gone by he has ruined by this system much of the fine shola round Kannikatty. He has taken a large slice comparatively recently out of the Peyar valley and left it a waste. He has ruined the Ullar valley which is now recovering from his depredations, and he has denuded the Kariar valley which has, however, nearly rehabilitated itself. He is now actively engaged in destroying the fine shola forest of Singampatti zamin and Kattalaimalai estate. The effect of his destruction on the flow of water in the Tambaraparni must be immense. Wherevr he has gone he has spread lantana which has been a further source of annoyance. He is a shiftless creature, who does not like to do any work. He will not uproot lantana because the grass cuts him, cannot attend the Survey party in Travancore because of leeches, and always has an excuse against doing anything at all except destroying a further area of forest. We have got rid of him from the Government forest with the exception of ten families located in Kariar and I trust that we shall get rid of him permanently."

The present day Kanis, however, have been apparently chastened by adversity, as they have been found to be willing though somewhat erratic workers. With the exercise of tact and kind but firm treatment, there is little doubt that they will in time form a valuable contribution to the labour supply in the interior ghat forests. The Hukdar of Kattalaimalai estate has converted some of them to Christianity, and although they remain indifferent Christians, he has found them good labourers. Labour from the plains is less able to bear the feverishness, inclemency of the weather and the loneliness prevalent in the ghat forests, and hence cannot be retained for more than a week at a stretch. Besides, it has to be paid at higher rates than Kani labour, and is much less efficient in planting operations and work which involves the use of a bill-hook. The total ignorance of most of our evergreen species exhibited by the average plainsman is also a serious objection against his employment in regeneration and tending operations in our evergreen forests. For these reasons, it would be advantageous to encourage the Kani, by giving him all reasonable concessions, to settle in our forests.

124. *Unskilled labour.*—The rates paid in the recent past for unskilled labour, employed in the various ranges of the division are given in the tabular statement below :—

	Man.	Woman.	Boy.	Reserve watchers per mensem.	Fire patrol per mensem.
Srivilliputtur Range.					
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1 Outer slopes	0 6 0	0 4 0	0 5 0	10 0 0	10 0 0
2 Interior ghats	0 10 0	0 7 0	0 7 0	12 0 0	...
Kuttalam Range.					
Kuttalam Range	0 6 0	0 4 0	0 5 0	10 0 0	8 0 0
Ambasamudram Range.					
1 Outer slopes	0 8 0	0 5 0	0 4 0	10 0 0	10 0 0
2 Mundanthorai plateau	0 9 0	0 6 0	0 5 0	...	...
3 Minor ghats	0 12 0	0 7 6	0 8 0	12 0 0	...
4 Kanis	0 8 0	...	0 6 0	10 0 0	...
Nanguneri Range.					
1 Outer slopes	0 8 0	0 5 0	0 5 0	10 0 0	10 0 0
2 Interior ghats	0 10 0	0 8 0	0 8 0	...	10 0 0
3 Plain forests	0 8 0	0 5 0	0 4 0	...	10 0 0

These rates, though lower than what was paid two years ago, are no doubt, now capable of further reduction. The term "outer slopes" denotes any locality on the hills from which the labourer can return to his village after the day's work.

The term "interior ghats" denotes places which are a full day's march from the villages on the plains and where labour has to camp with provisions, that is areas above the 2,000 feet contour. The Mundanthorai plateau includes Mundanthorai, Kariar, Kodamadi and their immediate surroundings.

The comparatively high rate for daily labour in Ambasamudram range is due to the keen demand for labour at the cotton mills at Papanasam. Labour is scarce in the Nanguneri taluk which is sparsely populated; hence comparatively high rates have to be paid.

125. *Skilled labour.*—Labour for building and carpentry and masonry works is paid on the following scales :—

	Mason first class.	Mason second class.	Carpenter first class.	Carpenter second class.	Sawyer.
Srivilliputtur Range.					
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1 Outer slopes	1 0 0	0 12 0	1 0 0	0 12 0	1 0 0
2 Interior ghats	1 8 0	...	1 8 0	1 4 0	1 8 0
Kuttalam Range.					
	1 0 0	0 12 0	1 0 0	0 12 0	1 0 0
Ambasamudram Range.					
1 Outer slopes	1 0 0	0 12 0	1 0 0	0 12 0	1 0 0
2 Mundanthorai plateau	1 4 0	1 0 0	1 4 0	1 0 0	1 4 0
3 Interior ghats	1 8 0	1 4 0	1 8 0	1 4 0	1 4 0
Nanguneri Range.					
1 Outer slopes	1 0 0	0 12 0	1 0 0	0 12 0	1 2 0
2 Interior ghats	1 4 0	1 0 0	1 4 0	1 0 0	1 6 0
3 Plain forests	1 0 0	0 12 0	1 0 0	0 12 0	1 0 0

It is to our advantage to engage skilled labour wherever possible on piece-work terms and not on daily labour. This is especially the case with felling and conversion in timber coupes, where payment on outturn represents the only way to overcome the difficulty of supervision. Sawyers for work in the evergreen timber coupes are not available locally except at prohibitive rates. They have, therefore, to be imported either from Travancore and Cochin or from Rajapalayam in Ramnad district. The west coast men are more acclimatised to work in evergreen forests, and are also finer workmen than the Rajapalayam sawyers, although the skill of the latter is not to be disparaged.

126. *Labour in fuel coupes.*—Exploitation of fuel coupes by contractors is carried out invariably on a piece-work basis referred to in paragraph 104 above. The coppicing of the tree stumps is beyond criticism, the Rajas, a Hindu caste, of Srivilliputtur range particularly excelling in this work. An agent or two is usually employed by the contractor for supervising the work in the coupe, and these men probably from long experience are expert judges of the outturn of a coupe. They are paid a monthly wage varying from Rs. 15 to Rs. 30 a month. Labour is recruited for work in the coupes by the agents, and the local fuel coupe contractor who advances large sums to *Kanganies* or recruiters of labour, practically controls the labour supply. The large amount of advances outstanding annually, acts as a powerful factor in compelling the previous year's fuel coupe contractor to take the current year's coupe, frequently at a sacrifice, in order that he may be in a position to recover the previous year's outstandings. His enemies are well aware of this, with the result that coupe prices at the public auction frequently reach uneconomic heights. Though at first sight this may appear to be highly satisfactory, it is not really to the advantage of the department, as it is not to our interest to ruin any contractor who has done good work for us in the past. Therefore when there is reason to believe that such a state of affairs exists it may be advisable to depart from the usual procedure and call for sealed tenders for a particular coupe instead of putting it up to public auction.

CHAPTER V.—PAST SYSTEM OF MANAGEMENT.

SECTION 1.—GENERAL HISTORY OF THE FOREST.

(*a*) *Early history.*

127. *The Indian dynasties.*—The dawn of history found the Pandyas in possession of the greater part of the division. Native tradition as well as ancient writings and inscriptions represent the founders of the Pandyan dynasty to be three brothers, Pandyan, Cholan and Cheran, of the now extinct village of Korkai, at the mouth of the Tambraparni. Pandyan according to tradition ruled over the present Madura, Ramnad and Tinnevelly districts. Of the antiquity of the Pandyan Kingdom there is ample evidence. Megasthenes who about 302 B.C. was sent as an ambassador by Seleucos Nicator, one of the successors of Alexander the Great, to the court of Chandra Gupta, King of Pataliputra, near Patna, speaks of a country called " Pandia " named after the daughter of the " Indian Hercules " Krishna. That the Pandias occupied a high political and social position may be inferred from the fact that the Roman Emperor Augustus sent an embassy to them. The Pandyan dynasty remained, as the rulers of the division or intimately associated with its history right up to the middle of the sixteenth century A.D. when it was replaced by the Nayakkan dynasty (1559–1736). The Nayakkan rule came to an abrupt termination with the Muhammadan invasion of 1736 under Chanda Sahib.

128. *The British conquest.*—The next period in the history of the division saw a struggle between the French and the British for the mastery of the Presidency. This struggle after many viscissitudes ended in victory to the latter, who in 1781, obtained from the Nawab of the Carnatic, the management and control of the revenues of all the Carnatic provinces including Tinnevelly and Ramnad on the condition that the Nawab was allowed a sixth of the revenue for his personal use. In 1790, a Board of assigned Revenues was created to administer the revenues and Mr. Benjamin Torin was appointed the first Collector of Tinnevelly. A decade of acute anxiety caused by a succession of Poligar (local chieftain) rebellions followed. Military reports of the suppression of these rebellions are replete with descriptions of the extent to which the dense jungle surrounding the forts of the Poligar Chieftains at Vasudevanallur, Sivagiri and other places in the plain country hampered military operations. The tracts in question are now quite bare of forest growth. On the 31st of July 1801, an agreement was effected with the Nawab of the Carnatic by which the exclusive administration of the Civil and Military Governments of all the territories and dependencies of the Carnatic was handed over to the East India Company in perpetuity. Mr. Lushington the first Collector of the district under the new Sovereign power, reported shortly after that the province of Tinnevelly had been brought " without the smallest disturbance under the company's authority."

It does not appear from the available information on the subject, that any steps were taken by the Indian Rulers to conserve the forest resources of the division. Cultivation was restricted to the rich river valleys, the intervening land being covered with jungle, which was infested by robber gangs who made travelling without a strong escort a risky adventure to be undertaken only under the direct necessity. The only attempt at conservation which deserves mention is the " tree-tax." Palmyras and some 38 kinds of trees, including teak, rosewood, mango, jack, *Bassia latifolia*, tamarind, soap nut, and marking nut trees enjoyed the dignity of taxation from very early times, the revenue from the palmyra tax being over a lakh of rupees and that from other trees being about Rs. 27,000 at the beginning of the Company's rule. The Government reserved the full right to the timber of these trees, only the usufruct of the tree being utilizable by the pattadar.

(*b*) *The British occupation* (1801–54).

129. *Early period.*—For years after the assumption of the district by the British the forests attracted but little attention from the Government; undoubtedly there was too much of it, and the conversion of a large part of it into cultivable land was most desirable. It appears that from the earliest times, ryots were permitted to fell and remove without permission or payment, wood for agricultural implements only, and fuel not exceeding a head-load at a time, for domestic consumption. Timber when felled was subject to a tax which in the absence of all supervision was easily evaded. The right to collect minor forest produce and to fell trees other than " valuable " ones for small timber for house building and for fuel was farmed out under the comprehensive term " hill rents " and formed a regular though insignificant item of the land revenue. In the periodical leases however no definition of what constituted a " valuable " tree was attempted, with the result that the renters under Government not only habitually felled valuable trees, but even claimed the sole prescriptive right to do so. This state of affairs was suppressed in 1842 when Sir H. Montgomery, the Collector, notified a list of ' valuable ' trees and prohibited their removal except on the receipt of permission from the Tahsildars and on payment of their value at fixed rates. In the interests of ameliorating the condition of the hill tribes who, it was considered, were being oppressed by the lessees, the ' hill rents ' were discontinued from 1854 under the orders of Government, at the same time the renter's privileges of felling other than ' valuable ' trees for fuel and general domestic purposes was extended to all classes of the population. This general licence, in the absence of adequate supervision soon resulted in the rapid destruction of the plain forests and the more accessible ghat forests on the outer slopes, so that the need for conservation and for a special conservancy staff soon began to be felt.

(*c*) *The Jungle Conservancy Period* (1854–66).

130. *Beginnings of conservancy.*—With a view to prevent the unrestricted felling of wood and the consequent destruction of jungles, to conserve the more valuable trees from the danger of extinction, and also to bring uniformity in the treatment of forest produce throughout every district in the Presidency, the Board of Revenue issued in 1860, circular No. 5497, which consisted of a simple set of rules called the Jungle Conservancy Rules. The subject-matter of the rules may be summarized as follows :—

(*a*) No timber tree, exceeding 3 feet in circumference at 2 feet from ground level nor any ' reserved ' tree in any jungle owned by Government was to be felled except with the permission of the Public Officers deputed for the purpose, and in such localities and on such conditions as they determined.

(*b*) Villagers could cut fuel for domestic purposes but not *for sale* in low jungle and brushwood without taxation.

(*c*) Charcoal burners could fell only in such places as were assigned to them by competent authority, and were prohibited from felling 'reserved trees.' A seigniorage of 1 anna per basket of one piled *para* was to be charged.

(*d*) Bonafide ryots were permitted to fell such wood (required for the erection of their own houses), as did not come under clause (*a*), provided that at least 29 standards per acre were retained on the area exploited for the purpose. No reason for the magic number 29 was advanced, nor were the girth measurements or species of the standards specified.

(*e*) Wood required for agricultural implements, as well as bamboos for bona fide domestic purposes, were permitted to be removed without payment.

(*f*) No fruit tree or sapling of timber species could be felled or injured.

(*g*) The trees 'reserved' for the value of their wood were—

1. Ebony.
2. Satinwood.
3. Teak.
4. Rosewood.
5. Palmyra.
6. Jack.
7. *Artocarpus hirsuta.*
8. *Terminalia belerica.*
9. *Terminalia paniculata.*
10. *Acacia arabica.*
11. *Albizzia lebbek.*
12. *Acacia catechu.*
13. *Hardwickia binata.*

(*h*) Trees reserved for the value of their products were—

1. *Anona squamosa.*
2. *Psidium guava.*
3. *Sapindus emarginatus.*
4. *Bassia latifolia.*
5. *Anacardium occidentale.*
6. *Acacia concinna.*
7. *Tamarindus indicus.*
8. *Calophyllum inophyllum.*
9. *Strychnos potatorum.*
10. *Mallotus philippinensis.*

(*i*) On fuel and bamboos cut *for sale*, a seigniorage of 5 annas per cart-load, 1 anna per bullock-load, and 3 pies per headload was to be levied.

(*j*) On timber cut *for sale* a seigniorage of Re. 1 per cart-load was to be paid. A *licence* and a *voucher* covered all removals from the forest.

(*k*) The collection of the revenue was to be undertaken by the village headman who was to be paid a commission amounting to 20 per cent of the revenue collected. Any misappropriation on his part was made punishable under Regulation IX of 1822.

(*l*) Cases of evasion of payment of the fees or unauthorized cutting of wood were made punishable according to the Penal Code under Fraud and Trespass.

131. *The Jungle Conservancy Fund.*—The revenue collected from these sources was allotted to the Jungle Conservancy Fund, and was to be expended in the raising of new plantations and the improvement of existing ones. The plantations were to be formed close to villages for the convenience and comfort of village communities and to guard against an eventual scarcity of wood. The Collector was given the liberty of administering the fund, subject to the submission of an annual report to the Board of Revenue in a specified form, showing the progress made and the amount collected and expended. Such were the humble beginnings of forest conservancy in the division.

132. *Defects of the system.*—The task of collecting the revenue and supervising removals soon provide too much for village establishments and a special conservancy establishment consisting of a supervisor and two peons was appointed for each taluk. The so-called '*licence and voucher*' system served at best only as a slight check on the extensive denudation of the tree growth which was taking place on the plains. Only the reserved trees were conserved, i.e., about a score of species out of the hundred or more which occurred in the forests. Many of the latter were capable of yielding fine timber, but being unreserved, even immature saplings must have been felled and

removed, as in addition to the jungle wood licences, every ryot was allowed to cut his requirements annually without payment or restriction. The effort to form village plantations was a total failure partly from insufficiency of funds and lack of knowledge of planting methods, but chiefly from the apathy and the utter indifference of the people themselves, their short sightedness in not appreciating the advantage of an undertaking, which did not appear to them to give an immediate or individual return, being commented upon by almost every Collector of the district. Again relying for its success as the system did on the village headman, who was in receipt of an outrageous commission on the revenue collected, it is not surprising that it proved wholly ineffectual to arrest the denudation of the ghats.

133. *Plantations.*—Another denuding agency deserves comment here. Between 1795 and 1800, nutmegs, cloves and species of all kinds were imported from the Moluccas by the Company's Commercial Resident and introduced on the slopes of the hills in the neighbourhood of Kuttalam, the peculiar climate of which was thought to lend itself admirably to the cultivation of such exotics. The gardens bore fruit in 1813 and samples of the nutmegs, cloves, cinnamon and coffee were sent to Madras for the European market. The produce was so unfavourably reported upon by the English merchants, that the gardens were all sold to the public at a loss, the spice gardens alone being retained as being of 'experimental' value. The expenditure on these gardens invariably exceeded the receipts. In 1843, the Collector Mr. E. B. Thomas with unusual horticultural zeal, set to, to prune, manure, and thoroughly overhaul the gardens with the result that they almost paid for themselves for a few years. He also introduced mangosteens, a little tea, and some cocoa trees. He made up some of the cocoa and gave it to some of his friends at Palamcottah, where as he somewhat cryptically reported "it was drunk without observation." In 1853 all the gardens (with the exception of the one over Panpuli which was handed over to Travancore) were sold for Rs. 9,841 thus saving the Government an expenditure of Rs. 3,000 a year on their maintenance. The experiment however encouraged native enterprise, with the result that large blocks of shola forest on the Kuttalam hills such as Terkumalai estate, were assigned by Government for coffee planting. These attempts proved equally unremunerative with the result that many of them were subsequently absorbed in the reserved forest. The estates mentioned below survive to this day. They still yield a little inferior coffee, nutmegs, cloves and a few mangosteens. Plantain cultivation is being attempted in Vasudeva Estate in Kuttalam but wild boar and elephant consume or destroy a lot of the produce. Some estates are mainly worked for charcoal, for example, Kuliratte and Hope Estates, and some for timber as is Terkumalai Estate. This naturally increases the chances of illicit removals from the adjacent Government forests and frequent inspections are necessary to ensure that no Government produce is removed along with the Estate produce.

Name of estate.	Extent in acres.
1. Udetam	11·23
2. Unjalkatti	9·00
3. Ramakkalteri	60·56
4. Terkumalai and Parathesipudai	615·91
5. Kuliratti	27·20
6. Spice garden	6·73
Total ...	730·63

134. *Coffee plantations.*—At about the same time a number of small coffee estates were being laid out in the Nanguneri hills the earliest clearing the Mahendragiri estate (now reserved forest) having been made in about 1840. The competition of Travancore coffee, leaf disease and the unsuitability of the locality for coffee, combined to ruin the enterprise. At the time of the forest settlement in 1902, the Nanguneri hills contained 27, such estates, some of which had been definitely abandoned while others had a name but no local habitation. At present there are only two small estates in the hands of the Nanguneri Mutt near Netterikkal. In one of them, the little Mampudai Estate, a few acres have been laid out with tea, which has not taken kindly to the locality. These attempts at coffee planting in the hills were responsible for the destruction of a considerable area of shola forest. The danger thus involved to the conservation of water and irrigation dependant on mountain streams was forcibly urged in 1865 by Mr. Mac Gregor, then Sub-Collector of Shermadevi, and it was owing largely to his efforts that a block of 500 acres in the Kannikatty evergreens escaped narrowly from the demand of a European coffee prospector.

(*d*) *Transition Period* (1865–82).

135. *Forest reservation.*—Meanwhile the subject of forest conservation had been taken up seriously by Government, and Captain Beddome was sent to the district in 1864 to advise the Collector generally on forest matters and to constitute the jurisdictions of the newly created 'Special Department' in charge of the forests of the division. Various parts of the ghats, amounting in all to about half the forest area of the division, were claimed as private property by no less than ten zamindars. The Kalakkad forests were claimed by the Tirukurangudi Mutt and though Government overruled these pretences the mutt carried the case to the High Court. The final decision in favour of Government was made only in 1909.

The whole of the ghat forests in Nanguneri Range, and such of the Papanasam forests as were not claimed by zamindars were brought under the Conservancy Rules alluded to above, and were placed in charge of a duffadar and three peons under the direct supervision of the Sub-Collector of Sermadevi. North of Kuttalam, the Vasudevanallur and Watrap Forests over which no private rights were asserted, were placed under an Overseer of the newly formed 'Special Department.'

136. *Defects of the system.*—The new arrangement soon proved unsatisfactory; the revenue officers had no time for forest work, and the Overseer, whose charge included the Madura Forests as well, found it too big for adequate supervision. Mr. Puckle, the Collector, declared that the only remedy was to hand over the complete charge of the ghat forests to the 'Special Department' and this was done in 1866, Captain Fullerton being appointed the first District Forest Officer of the combined Tinnevelly and Madura Forests.

137. *Collector Puckle.*—Mr. Puckle deserves a paragraph for himself. His zeal for conservancy outran even that of the Forest Officers of the period. His statement of the situation in 1866 deserves to be quoted *in extenso*. He said "The prosperity of the river irrigated section of Tinnevelly extending through five taluks is dependant on a continuous flow of water in the rivers that rise in the western ghats. This continuous flow has notably decreased of recent years, and the decrease commenced with the destruction of much of the forest that formerly clothed the ghats and protected the head waters of the streams; the rich sholas in the ravines down which the streams descend, attracted coffee planters, who destroyed the magnificient timber and thus let in the wind which has extended the mischief done by the axe. Thousands of trees lie prostrate and the coffee gardens are mostly wind blown and useless. Where the ground was once continuously moist, it is now parched and dry and the course of numerous little rivulets that once fed the larger streams are now rocky nullahs devoid of water. The mischief is done so far, and cannot now be repaired, but what we can do is, to conserve the remaining forest most carefully, with a view to increase the number of perennial streams. The people themselves are unanimous in their desire for conservancy as even at the foot of the hills they now begin to suffer, and lower down the streams there is always an outcry for water." Mr. Puckle accordingly prescribed the issue of licences to cut timber; he forbade cultivation (except coffee), and charcoal burning in the forests, and restricted grazing and the cutting of fuel by the ryots to certain limits defined separately for each village. In this respect he did not initiate a new policy as his predecessors Messrs. Bird Eden, Montgomery and Thomas had since 1837 prohibited dry cultivation on the slopes of the hills "as it tended to the clearing of forests which rendered to the mountains bare of trees and thereby prevented the clouds from descending on the hills during the monsoon thus resulting in scarcity of rain." While however his predecessors hoped to increase the rainfall by promoting conservancy, Mr. Puckle was guided in his action by more correct views regarding the effect of forests on surface drainage. Captain Beddome felt that these prohibitions endangered forest revenue and advocated a system of regulated fellings. Mr. Puckle, on the grounds that the irrigation of the district would be seriously jeopardized if Captain Boddome was allowed to have his way, appealed to Government, who warmly supported him. In 1869 Captain Beddome revisited the division and reported that the best efforts of every one concerned had failed to secure anything that could properly be called conservation.

138. *Private forests.*—The problem of the private forests in the division still remained unsolved. The claim most antagonistic to the new reservation policy of Government was that of the Singampatti Zamindar. The Singampatti forests commanded the upper reaches of the Tambraparni and the sources of a number of the affluents of this important river. There were several alternatives; to take the forests on lease; to resort to litigation; to acquire the property under the Land Acquisition Act; or to override what was considered the doubtful claims of the zamindar by assuming the property. As a result of litigation in the High Court, the zamindar was successful in establishing all his

claims, and this decision was ultimately confirmed by the Privy Council. In spite of the best efforts of Government therefore this valuable catchment area was lost to the department.

A large area of some 8,000 acres of shola forest has been leased out by the zamindar during the last decade to the Bombay-Burma Trading Corporation for conversion into tea estates. The District Irrigation Committee has protested strongly against this alienation, on the ground of the possibly deleterious effects the destruction of shola forest in the catchment area of the Tambraparni, may have on the regular flow of water in this river. Fortunately owing probably to the depressed state of the tea industry, only a small portion of this area has been felled and the damage done to the catchment area is not yet apparent.

The claims of the other zamindars, Chokkampatti, Sivagiri, Vairavankulam and Tirumalainaicken Pudukkudi, were considered of less importance from the point of view of irrigation and hence no attempts were made either to contest or to secure control over them. The existence of these zamindaris to the present day, sandwiched as they are between tracts of Government forests, forms a great obstacle to the practical management of the forests of the division. Owing to the laxity of supervision prevalent in zamin forests, fires are of common occurrence and are a menace to the adjacent Government forests, necessitating the annual maintenance of expensive fire lines along the common boundaries. This, combined with overgrazing, has resulted in such a deterioration of many of the more accessible zamin forests, that the state of the adjoining Government forests forms an object lesson, even to the uninitiated eye, on the benefits of forest conservancy.

139. *The Kattalaimalai Estate.*—In the Papanasam reserve a private forest of some 1,000 acres called Kattalaimalai Estate was claimed by the Chokkampatti Zamindar. Situated as it was in the catchment area of the Tambraparni and one of its principal affluents, the Kariar, various expedients were tried to secure it, until in 1876 the project was finally abandoned. An opportunity for acquiring it by purchase in 1893 was lost, the property going to the Roman Catholic Mission in a court auction for Rs. 17,000, a trifling sum considering the importance of acquisition. It contains at present about 330 acres of coffee estates, 125 acres of which are in bearing, an extensive fruit garden (limes, oranges and coconuts) which is leased out annually for Rs. 3,000 and has an income of about Rs. 1,500 per annum from the sale of fuel on cart-load permits.

140. *Reservation on the plains.*—With the progress of conservation the demand for fuel and small timber expanded enormously, and in order to relieve the pressure on the ghat forests, a scheme for the development and reservation of treegrowth in the plains was taken up in 1871. The immediate object in view was to supply fuel to the South Indian Railway, the extension of which to the Tinnevelly district was then under contemplation. A start was made with five blocks of waste land near Palamcottah. The scheme of plantation failed owing principally to a lack of knowledge of the silviculture and technique of planting of the indigenous species tried. The project was therefore abandoned.

141. *Tank-beds.*—Attention was next concentrated on the various tank-beds scattered over the division, where the natural growth of *Acacia arabica*, *Prosopis spicigera* and *Acacia planifrons* was attempted to be fostered and extended. The revenue and forest authorities from the beginning disagreed over the management of these reserves, particularly in regard to the restriction the latter wished to enforce as to the rights of villagers to fell timber for agricultural implements, and to graze their cattle. The protection of the reserves, some 18,500 acres in extent in 1,876 was therfore never complete. The tank-beds were divided into five circles and placed in charge of a Sub-Assistant Conservator Mr. Lowry but this was found too expensive and he was soon replaced by a Forest Ranger. The reserves never paid their way as is revealed by the following figures :—

	Revenue.	Eexpenditure.
	RS.	RS.
1871–1881	15,534	21,511

As a result of the difference of opinion between the forest and revenue authorities referred to above, the reserves were constantly shifted about from forest management to that of ' jungle conservancy ' with the result, as Captain Beddome states that " cattle were allowed to graze indiscriminately and it was found impossible even to exclude goats."

The Conservator accordingly proposed in 1878 that these reserves should be transferred to the Revenue or Public Works Departments directly the expenditure on them was recouped. In 1881–82 all these reserves were transferred to the Revenue Department in accordance with G.O. No. 112, dated 27th January 1882 and a sum of Rs. 1,597–11–2

being the amount spent in excess of receipts, was transferred from the Jungle Conservancy Fund to the credit of the Forest Department. During the following years these reserves which were unsurveyed, but were estimated to amount to some 18,000 acres scattered throughout the division, were worked by the Tahsildar assisted by the old forest subordinate staff and the village officials. In G.O. No. 719, Revenue, dated 25th July 1887, it was ordered that as Government were of opinion, that the forest growth on tank-beds, should not be placed at the unfettered discretion of village officials, the management of such areas should be exercised through the Forest Branch of the Collector's office "where the interests involved required a more detailed supervision than could be exercised by the ordinary revenue establishment," but that the Forest Officer should not interfere where the trees on tank-beds were few in number.

142. *Revenue from tank-beds.*—Meanwhile, owing largely to the fact that the annual exploitation was considerably in excess of the annual possibility of the forest as determined on the principle of a sustained yield, the revenue from this source that is, babul in tank-beds, had increased enormously. The figures for the period 1885–86 to 1895–96 are given below :—

Year.	From trees.	From pods.
	RS.	RS.
1885–86	5,374	3,236
1886–87	4,372	4,211
1887–88	5,945	4,577
1888–89	12,607	2,714
1889–90	5,556	4,375
1890–91	18,631	4,012
1891–92	18,092	2,354
1892–93	17,551	2,375
1893–94	19,841	99
1894–95	14,382	4,336
1895–96	2,402	6,094
Total ...	1,24,853	38,363

Thus a total revenue of Rs. 1,63,216 had been collected during a period of 11 years—an annual yield of Rs. 15,000 approximately. Under G.O. No. 260, Revenue, dated 2nd March 1885, it was ordered that all revenue derived from tank-beds, after the legitimate wants of the villagers had been met, was to be credited to "Forests" and not to "Land Revenue". The claim set up by the Forest Department to the trees in tank-beds was thus indirectly recognized.

143. *Defects of the system of management.*—The dual control of the tank-beds, the direction being by the Forest Officer and the execution by the revenue establishment, proved most unsatisfactory. In 1887, Mr. Brasier, the District Forest Officer, issued the following regulations for the management of these areas :—

(*a*) The fellings should be conducted over a portion of a tank, if it was a large one, with many trees, but over the whole tank if small.

(*b*) About 25 of the *soundest* trees should be retained per acre as seed bearers such trees being marked and numbered serially.

(*c*) The other trees in the area above one foot girth at breast-height should also be counted and marked at the base so as to distinguish stumps sanctioned for sale when the trees were felled.

(*d*) The list of trees for sale and an estimate of the yield in cart-loads should be submitted with the sale list for confirmation.

(*e*) All areas felled over should be rigidly closed to grazing. (The period of closure was not specified.)

(*f*) An area was to be considered ripe for felling if the majority of the trees were over six years old.

No definite scheme was prepared on the lines suggested by Mr. Brasier and supervisors were left largely to their own devices. The attempts at excluding cattle were desultory and were soon abandoned, as the Tahsildars complained to the Collector that forest officials were interfering with the immemorial rights and privileges of the people. The rights of posterity do not appear to have been considered concurrently.

In 1896, the whole question of the management of these tank-beds was reconsidered in all its aspects. It was realized that unless they were constituted as "Reserved" forests, the forest officer would have no power to prohibit grazing when necessary. Since nearly all of them were below a square mile in extent and scattered all over the division, it seemed inadvisable from the point of view of supervision and expense, to reserve them. Mr. Hooper, Conservator of Forests, proposed that in view of the large revenue obtained from this source, the tank-beds should be protected by the grouping of them into working circles and the preparation of simple plans for their future management. This was all the more necessary as he considered that the areas had been overfelled in the past. The responsibility imposed on the eight supervisors, one for each taluk in controlling the work of the village officials and collecting the revenue was wholly disproportionate to the salary they drew Rs. 20 per mensem. Besides the District Forest Officer there was no one to supervise their work, and the necessity for corresponding with each of these officers direct, unnecessarily increased the office work in the District Forest Office. Mr. Hooper accordingly suggested that a special officer be deputed for the preparation of working schemes for all the tank-beds, and that their future management be vested in the Tahsildar under the control of the District Forest Officer. In Board's Proceedings Forest No. 375, dated 15th August 1896, the Board of Revenue stated that it was unable to support the proposal for reservation as it believed that "prohibition of the reservation of small scattered areas in the midst of cultivated land was specially called for in the case of tank-beds, in which free grazing was a highly valued privilege, and where excessive babul growth was injurious to the tanks as sources of irrigation". The Board while admitting that gradual degradation of tree growth was to be expected in tracts which received no greater protection than that afforded by section 26 of the Forest Act, were of opinion that babul growth on tank-beds was the one possible exception, as the species was unusually hardy and conditions for reproduction from seed exceptionally favourable. As regards the hardship to the villagers that was likely to result from the loss of babul by gradual degradation, it was observed that if the supply of fuel to the railway and factories from tank-beds, was strictly limited to the *surplus* produce there would remain an ample stock from which to meet the villagers' requirements for years to come. When this was found no longer to be the case, the question of reservation was ordered to be raised again, if such a step was considered advisable.

144. *The present position.*—The management of tank-beds thus still remains in the hands of the revenue authorities and from the fact that the average annual revenue has sunk to a little over Rs. 1,000 it may be deduced how successful the system of management has been in conserving this important fuel resource of the plains. The District Forest Officer is still consulted, on rare occasions on professional matters, but as he never inspects the areas he has little opportunity of knowing whether his advice has been carried out. The tank-beds not being reserved forests do not come under the purview of this plan but a detailed examination of the present state of affairs with a view to remedy matters, if possible, is advocated. Fuel is a produce which cannot on the score of expense bear transport by rail for long distances, and in the interests of providing the ryot of the plains with a cheap supply of fuel, and also with the object of fostering industries relying on cheap fuel for power, such an examination would be of value. Besides with the increasing pressure of population the area under regular cultivation is bound to increase. It will therefore be found ultimately necessary to increase the productive capacity of tank-beds by raising fuel and small timber on them, with a view to releasing land at present covered with sparse scrub jungle for cultivation.

(*e*) *The Forest Committee* (1878–82).

145. *Village forests.*—In the ghat forests the old system of allowing ryots to help themselves to small timber and fuel, and to graze their cattle in all areas under "conservancy" free of charge was still in force; the permission of the Tahsildar was theoretically at least necessary. Illicit fellings however continued, as in the absence of any definite law on the subject, prosecutions very seldom secured convictions. In the Tenkasi taluk, Mr. Puckle when conducting the settlement, had marked off by a clearly cut ride—the so-called "cairns line" of the present day—the lower slopes, which he intended should serve as "village forests". All the area below the line was considered communal forest and open to free felling and grazing. Above the ride, free removals were prohibited, grazing excluded and fire kept out; in fact the area was a reserved forest. The latter tract showed such a marked improvement that the change for the better was easily noticeable and was commented on even by the ryots of the division. This scheme of separation of "communal" and reserved forests received the warm support of Government, but was not extended to the other taluks of the division immediately.

146. *Permanent reservation.*—It was largely owing to Colonel Beddome's and Mr. Pennington's efforts, that conservation of a permanent character was introduced in the division. In 1878, the former reported to Government as follows:—" The district had a rude example of what a flood can do, on the 18th of December 1877. I understand that the damage to bridges, roads and tanks is not less than 1½ lakhs of rupees, besides the damage to crops and salt. It would be a bold assertion to say that the comparatively small felling which has already taken place, added much to the volume of the flood; but I visited the tract to see the effects and have no hesitation in saying that, to a certain degree, its intensity must have been increased. The splendid leaf canopy of the evergreen forest is so dense that it rains for some minutes before any drops come through, and then it comes down so lightly that it is soaked up by the soft humus and debris that forms the upper stratum of the surface soil. Where the trees are felled and burnt for coffee cultivation much of this humus is burnt and the rest is swept down by the forest heavy rains; after this whenever there is violent rain, it rushes off down the sides of the mountains forming numerous sluices where none existed before. If the rest of the Kattalaimalai estate is felled I anticipate serious results, and if it is not too late to interfere I believe it would be a good policy to pay a large sum to save the remainder from destruction. The Singampatti forests are threatened, and I believe doomed, if Government don't interfere. If it, or any great portion of it is felled it will be an act of vandalism that will be bitterly resented when it is too late and it will be impossible to say what ruin it will not bring on the Tinnevelly district." Mr. Pennington in forwarding this very excellent *expose* of the case to Government said " The report appears to me to be absolutely conclusive as to the very urgent necessity for immediate action if the magnificent irrigation system of the Tambraparni is not to be utterly destroyed. It is a matter of immediate necessity that we should secure the control of the Kattalaimalai estate and ultimately of the Singampatti forest. I am satisfied that the delay that has occurred has already been the cause of incalculable damage and if nothing is done soon, it will not be long before the ruin of the river valley will have been completed and we shall have to write " too late " on our forest legislation in Tinnevelly. The Board was of opinion that " if the views so strongly held by the Conservator and Collector were even approximately correct, the interests of cultivation paying a land revenue of about fifteen lakhs of rupees were most seriously endangered." It strongly urged that action should be taken for the passing of a Forest Act, so that Government could be armed with full powers to act when the necessity arose.

147. *The Forest Committee.*—In 1878 a committee consisting of Colonel Campbell, Walker, the District Forest Officer, Mr. Hayne, and the Collector Mr. Pennington was appointed to consider the important subject of reservation and to advise generally on future forest policy in the division. Their recommendations may be summarized as follows:—

(*a*) The principle first adopted by Mr. Puckle of dividing by a cleared line the forests to be reserved from those, on the outer slopes, which were to be assigned for communal purposes was accepted. The " cairns line " was accordingly extended in the ghaut forests of all the taluks.

(*b*) The whole reserved forest of the district was divided into seven blocks as follows:—

Taluk.	Number of blocks.	Area of blocks square miles.	Total forest area square miles.
Nanguneri	1	49·27	89·45
Ambasamudram	1	142·20	238·85
Tenkasi	3	28·14	53·19
Sankaranainarkoil	1	30·84	78·83
Srivilliputtur	1	36·36	98·87
Total ...		286·81	559·19

(*c*) No fresh pattas were to be granted in the ghaut forests.

(*d*) In the blocks proposed for reservation it was recommended that if pasture was to be permitted, it should be on payment, as it was found on enquiry that no rights of grazing existed in these areas.

(*e*) Arrangements were to be made to secure the conservation of private forests at the hands of their owners.

(*f*) Small portions of the communal forests were to be closed to grazing for reproduction and improvement, and free grazing was to be permitted in the open areas under such safeguards against fire and other damage as might be decided upon by the Collector and District Forest Officer.

The proposals were accepted by Government but no further action was taken until the Madras Forest Act was passed into law in 1882.

148. *Dr. Brandis' visit.*—Dr. Brandis' visit to the division in February 1882 was a landmark in the forest history of the division. His voluminous report, in which he outlined the future forest policy to be adopted still remains a monumental work and has been the basis of many of the working plans which followed. The object of forest conservancy in the division were stated by him to be—

(*a*) The protection of the ghaut forests in order to secure the continuance of the water-supply in the various river systems upon which the irrigation, and hence the prosperity of the ryot depended.

(*b*) The maintenance of the fuel supply and the increase of fodder during seasons of such waste lands as could be set apart for forest growth.
of such waste lands as could be set apart for forest growth.

149. *His recommendations.*—(1) With a view to securing the former object he recommended that no more land whatsoever be alienated on the ghauts for coffee or any other cultivation. He realized the importance of encouraging the growth of coffee and other paying crops and of promoting the settlement of Europeans on the hills, but was of opinion that the benefit derived from such cultivation would be insignificant as compared with the damage that would be done, if the water-supply available for irrigation in the plains was diminished. He anticipated that the hardship involved by this prohibition would not be great as the eastern slopes of the ghauts were not well suited for coffee, too much money having already been lost on the cultivation of this product.

(2) He also recommended that the whole area above the outer line laid down by the Revenue survey as the limit of cultivable land, should be reserved under the Forest Act, as far as it was at the disposal of Government. This radical proposal had the effect of obliterating the communal forests proposed by the Forest Committee of 1878, but was defended by Dr. Brandis on the ground that although it might restrict the extension of cultivation and prevent the development of private enterpise on the outer slopes it was infinitely more important in the interests of irrigation on the plains, that these forests should be preserved and extended. Besides it was realized that a boundary half way up the hills would be difficult to select and maintain, besides increasing the difficulty of effectively conserving the inner reserves from illicit removals.

(3) As regards the requirements of the villagers adjoining the forests he recommended that these should be met from waste lands within the Revenue survey limits and if this was not possible, free pasture and the cutting of fuel and small timber for agricultural implements should be restricted to those areas which were *outside* the blocks set apart for protection from fire, with a view to their improvement.

(4) On the subject of fire protection Dr. Brandis was prolix. He attributed the degenerated state of the forests more to annual fires than to excessive felling. He said that " the evergreen forests were being eaten into on their edges and their area reduced annually. The deciduous forests were kept in an open and stunted condition; young seedling growth and coppice regeneration were destroyed and the soil was maintained in a hard and impoverished condition, which was detrimental to the retention of rainfall, so important a factor from the point of view of regulating the flow of rivers and streams." With the object of preventing fires he advocated that the assistance of persons who graze cattle in the reserves should be secured; shifting cultivation carried out by the hill tribes should be regulated; fire lines should be cleared and burnt round selected blocks of the more valuable forests; private enclosures in the reserves should be clearly demarcated and the owners compelled to keep them clear under Chapter IV of the Forest Act.

Finally an establishment of fire watchers should be organized and recruited principally from the hill tribes residing in the forest and a portion at least of their remuneration should depend upon their success in protecting the areas assigned to them.

150. *Forest revenue.*—Timber, consisting chiefly of *Hopea parviflora*, teak *Pterocarpus marsupium, Vitex altissima* and *Balanocarpus utilis* was being extracted at the time from the ghaut forests. It was felled and converted by the axe into scantlings and brought down by contractors who were paid at fixed rates per cubic foot, to the depots at Kalakad, Ambasamudram and Sankaranainarkoil.

Fuel and charcoal from the ghaut forests were removed on payment of the following rates of seigniorage :—

	Head load.			Cartload.		
	RS.	A.	P.	RS.	A.	P.
Junglewood	0	2	0	2	0	0
Firewood	0	0	5	0	6	0
Charcoal	0	1	6	1	8	0

Minor forest produce was also extracted, the produce being bought from the collectors at depots, by the department, at certain rates and sold thereafter by tender. Dr. Brandis advocated the continuance of the prevailing system of extraction but favoured the restriction of removals to the areas which were *not* specially fire protected. He estimated the average annual revenue from these sources to be—

	RS.
Timber	10,000
Fuel and charcoal	7,000
Minor forest produce	5,000
Total ...	22,000

Dr. Brandis expected that together with the grazing revenue and with more careful management under a wholetime officer, the revenue could be increased to Rs. 32,000.

151. *Forest expenditure.*—As against this he anticipated that the following annual outlay would be necessary :—

	RS.
Fire protection	10,000
Rest-houses and roads	6,000
Establishment	16,000
Total ...	32,000

Adding to this the outlay on account of revenue, Rs. 8,000 a year, he hoped that under good management the *deficit* would not exceed Rs. 8,000 a year. On the plain forests he anticipated a loss of Rs. 2,000 a year, making the total *deficit* of the division Rs. 10,000 a year. In justification of this gloomy forecast he quoted Mr. Puckle as having said " The Forest Department in this district should not be judged entirely or chiefly by financial results. Its principal work is to preserve the sources of streams on which the prosperity of the district depends and if it succeeds in this Government should I think be satisfied."

(*f*) *The Period of Organization* (1882–87).

152. *Organization.*—During the five-year period 1882–86, succeeding Dr. Brandis' visit, the work of the staff consisted mainly in the organization and distribution of establishments, fire protection of selected blocks, and collection of revenue to meet the expenditure on these items of works. The present Kalakad and the Padarmalai and Koilteri Felling Series were the first areas to come under special protection. The whole of the extraction was still under the licence and voucher systems, which was developed by the Forest Department, permit gumastas being instituted, checking stations established and additional watchmen and forest guards being employed to control and supervise, removals. In 1884, Mr. Cherry issued orders that this system should be curtailed and localized, tracts being marked off for the purpose, and that other areas should be placed under special protection for future working; such specially protected areas were to be worked under selection fellings by compartments and sub-compartments, all mature and badly grown trees of all species being extracted and the natural regeneration of the better species being carefully tended. Valuation surveys of the crop on which simple working plans were to be based were also ordered to be made. The only maps available were those prepared by the Forest Committee, containing no topographical details. These were ordered to be corrected and added to by the staff. The Timber Transit Rules were also drafted and made applicable to the ghauts forests.

153. *Method of working.*—In 1886, Mr. Campbell Walker again condemned the licence and voucher system. Under it he said, " hundreds of men enter the forest daily, cut under no regulation, do infinite damage, and numerous issuing and recovering officers have to be employed to collect the fees, which they supplement by petty exactions on their own account ". He urged its gradual substitution by departmental working or working through the agency of responsible contractors. In 1888, Mr. Walker reported that unrestricted entry and felling on permits had ceased and been replaced by regular fellings under departmental supervision, even persons permitted to remove headloads of dead wood being required to remove them from the annual *coupes*. This was a vast stride in the right direction and Mr. Brasier, the District Forest Officer, was highly commended for the change he had effected with the apparent acquiescence of the ryot. It is interesting to note that the first ' annual coupe ' of 30 acres felled departmentally in 1886–87 in

the Kuttalam reserve resulted in a loss of Rs. 7 per acre, the " coppice with standard " system being adopted. Silviculturally the system was reported to be successful, as the one-year old coppice was over 6 feet high and the ground was carpeted with seedlings. The weakness of the method, however, was that the areas selected were scattered, and hence difficult to control, and the best growth was always being felled.

154. *Evergreen timber extraction.*—In the evergreen and semi evergreen forests of the ghauts of the Ambasamudram taluk, all hollow and evermature trees of saleable species were being extracted under the *Jardinage* selection felling method with a view to improving the forest. About 6,000 cubic feet of *Kongu* (*Hopea* and *Balanocarpus*) was being extracted annually, the wastage in conversion by the axe being as high as 50 per cent. The unsaleable material was converted into charcoal however and this close utilization was warmly commended by Mr. Cherry, on the score that it not only cleaned up the forest but also yielded a not insignificant revenue.

The Working Plan Era (1888–1915).

155. *General.*—The success of the departmental working of the early " coppice with standard " coupes soon encouraged contractors to come forward to undertake the whole work of extraction and sale of the produce, thus relieving the small staff of a great deal of responsibility and enabling it to concentrate its energies on the more important work of reservation and construction of roads and buildings. The system of selling the produce standing was introduced in 1889, Mr. Cherry remarking in 1892, that " coupe contractors who appear to have bid too highly for past contracts are becoming chary of taking up fresh areas ". With the idea of re-establishing confidence lower prices were ordered to be accepted.

156. *The first working plan.*—From 1891, the system of working areas on the principles of a sustained yield was introduced, and four years later a small working plan for 3,046 acres—the Padarmalai Working Circle—was prepared and sanctioned. The next decade saw a regular spate of similar working plans covering the greater part of the workable area of the forest. The following table gives a list of such working plans :—

Serial number.	Date of sanction.	Authority.	Name or working circle.	Area in acres.	Author.
1	1895	B.P. No. 1107	Padaramalai	3,046	H. B. Bryant
2	1897	B.P. No. 44	Kuttalam	1,839	Do.
3	1897	B.P. No. 44	Sivaisalem	3,154	Do.
4	1897	B.P. No. 2721	Ayyanarkoil	4,296	Do.
5	1897	B.P. No. 2721	Valaikulam	1,145	Do.
6	1897	B.P. No. 2721	Rengarkoil	2,265	Do.
7	1897	B.P. No. 378	Kalakad	3,264	Do.
8	1898	B.P. No. 55	Kadayanallur	1,670	Do.
9	1898	B.P. No. 62	Karuppasamikoil	1,847	Do.
10	1901	B.P. No. 247	Vallanad	5,087	P. M. Lushington.
11	1901	B.P. No. 250	Teri Reserve	13,840	Do.
12	1901	B.P. No. 263	Milvittan	616	Do.
13	1901	B.P. No. 336	Sattur	2,995	Do.
14	1902	B.P. No. 210	Pudupatti	1,167	Do.
15	1902	B.P. No. 211	Tirukurangudi	2,538	Do.
16	1902	B.P. No. 213	Srivilliputtur ghaut forests.	38,035	Do.
17	1902	B.P. No. 276	Nanguneri	55,677	Do.
18	1902	B.P. No. 292	Ottapidaran	616	Do.
19	1902	B.P. No. 295	Vaippar	2,995	Do.
20	1902	B.P. No. 295	Tinnevelly	...	Do.
21	1903	B.P. No. 121	Koilteri	1,909	Do.
22	1903	B.P. No. 286	Terku Viravanallur	5,969	Do.
23	1903	B.P. No. 129	Srivaikuntam	...	Do.
24	1903	B.P. No. 130	Kotamadakki	1,811	Do.
25	1903	B.P. No. 53	Kalivayur	158	Do.
26	1911	B.P. No. 189	Puliangudi	3,100	H. A. Latham.
27	1916	B.P. No. 893	Vadagarai melpidigai and Kilpidigai	458	D. T. Barry

N.B.—Items 13, 18, 20 and 22 apply to the babul growth in tank-beds which were unsurveyed and hence the area covered by these plans is not known.

157. *Objects of the working plans.*—The chief objects of these working plans were—

(1) To define the areas to be strictly protected with a view to the preservation of water sources.

(2) To regularize in a simple manner the exploitation of timber in the evergreen forests and the higher semi-deciduous forests.

(3) To control grazing.

(4) To arrange systematically for capital expenditure on roads and buildings with a view to the future development of the forests.

(5) To supply the neighbouring population with small timber, fuel and charcoal, on the principles of a sustained annual yield.

How these objects were *sought* to be attained will be commented upon below.

158. *Protection.*—With the object of preserving the catchments of the more important rivers and streams, so-called, " Working Circles " covering the higher reaches of these waterways were constituted, their boundaries being defined; both felling and grazing were prohibited in these areas. It was anticipated that under " complete rest " nature would reclothe these areas effectively by the gradual extension of the existing shola and semi-deciduous forest.

159. *Evergreen timber.*—The working prescribed in the more accessible and exploitable evergreen and semi-deciduous forest consisted in the division of each working circle into coupes, the usual felling cycle being six years. The possibility was fixed at a *maximum* of one tree per acre, the exploitable girth being 6 feet and over for *Vitex altissima*, and 4½ feet and over for other species. The trees were to be marked and sold standing, and payment was to be made in a lump sum for all the trees marked, and not calculated on the outturn. These prescriptions however were not carried out in accordance with the intentions of the Working-Plans Officer, as although the average of one tree per acre was never exceeded for the whole coupe, the marking was far heavier in portions of the annual coupe. The girth limits prescribed also seem to have been unnecessarily low.

160. *Grazing.*—The whole area which was not closed to grazing for silvicultural reasons, namely, for the protection of water sources and to enable the natural recuperation of over grazed areas, was divided into grazing compartments. It was customary at the time for graziers to use the lower slopes from November to May making daily excursions to the forest for the purpose, but from June to October the surplus cattle were penned in the higher grass lands, as the grass on the lower slopes was too mature to be palatable. This led to the formation of the so-called " hill grazing compartments," each group of grazing compartments on the lower slopes having its alterative hill grazing compartment. Grazing prior to the introduction of working plans was paid for at two rates, for privileged and unprivileged cattle respectively. The *modus operandi* of the system was as follows :— The karnam furnished each applicant with a certificate that he cultivated a certain acreage of land. For every five acres, the applicant was allowed to graze two bulls and one cow at half rates and for any surplus cattle he paid full rates, i.e., two annas per cow unit. The Range Officer concerned issued the permits and collected the fees. The real check on false certificates from karnams was the risk of discovery with the pains and penalties, criminal and departmental that followed. In 1891–92, the rates were raised to four annas per cow unit, and in 1896, the distinction between privileged and unprivileged cattle abandoned, the rate per cow unit being simultaneously reduced to three annas. With the object of preventing the young re-growth in fuel coupes from damage by cattle, all such coupes the growth on which was below six years old were closed to grazing.

161. *Roads and buildings.*—Although the capital expenditure on roads and buildings formed a prescription in these working plans, both the actual expenditure and the necessity for it was subject to the control of the Conservator when the estimates were submitted to him for approval.

162. *Method of working.*—As regards working in the deciduous forests the system of working varied according to circumstances. In the Ambasamudram Range departmental fellings were persevered in, the produce being sold in lots *in situ*, the smaller fuel being removed on the permit system on payment of seigniorage and the balance well heaped and burnt. In Sivaisalem the coupe was sold to a contractor. In Kuttalam departmental working was going on but the felled produce was sold to a contractor by tender. In Nanguneri the permit system alone was in use, gleaners having to cut under supervision in the year's coupes. The ideal aimed at, however, in all cases, was to substitute gradually, contract for departmental work as soon as the yield of the coupes could be accurately gauged by statistics of previous fellings, so that reliable contractors would come forward to take the coupes at a fixed price per acre and do the felling and extraction themselves under departmental supervision. It was apparently when this latter stage was reached in a particular area that a working plan was prepared, as all the plans prescribed the sale of the coupe to contractors.

163. *Silvicultural system.*—The system of management prescribed in these forests was invariably a modified " coppice with standard " system, modified because no rotation for the standards was contemplated or fixed. All the working plans were directly silent as to the reason for the adoption of this system with the result that the matter is left to conjecture

164. *Artificial regeneration.*—None of the working plans seem to have anticipated the necessity for supplementing natural regeneration by artificial means wherever necessary. This was their most serious defect and is one of the reasons why the present fuel series

are far from being normally stocked. Such artificial regeneration as was done, was largely due to the enthusiasm of individual District Forest Officers and will be commented upon in paragraph 189 below.

165. *Superior staff.*—The District Forest Officers of this period were :—

	Name of officer.	From	To.
1	Mr. Hayne		1878—1884.
2	„ Brasier		1884—1891.
3	„ Thornton	April	1891—May 1895.
4	„ Moss.	June	1895—September 1895.
5	„ H. B. Bryant	October	1895—1899.
6	„ P. M. Lushington		1899—1st April 1903.
7	„ R. D. Richmond	1st April	1903—15th May 1905.
8	„ H. O'neill	16th May	1905—15th August 1905.
9	„ R. D. Richmond	16th August	1905—17th March 1906.
10	„ H. O'neill	18th March	1906—19th March 1906.
11	„ D. T. Bary	20th March	1906—21st March 1907.
12	„ R. D. Richmond	22nd March	1907—3rd January 1908.
13	„ H. A. Latham	4th April	1908—24th March 1910.
14	„ Treasury Deputy Collector	25th March	1910—28th March 1910.
15	„ A. B. Myers	29th March	1910—28th April 1910.
16	„ H. A. Latham	29th April	1910—1st January 1912.
17	„ D. N. Strathie, I.C.S.	2nd January	1912—11th January 1912.
18	„ A. B. Myers	12th January	1912—21st January 1912.
19	„ T. P. Peake	22nd January	1912—16th September 1915.

(*f*) *The Recent Period* (1915–33).

(1) Working Plans.

166. *Revision of working plans.*—In 1915 and the years following many of the old working plans were due for revision, and new working plans for hitherto unworked areas had to be prepared. The appointment of a Working Plans Officer was contemplated as early as 1915, but owing to the Great War and the consequent shortage of officers, no officer could be spared till the 6th September 1917, when Mr. G. C. Robinson was appointed as Working Plans Officer. This officer was provided with a small staff and the work of collecting information on which to base the working plan for the whole division was proceeded with. Unfortunately Mr. Robinson was transferred on 4th February 1919 before he could complete his work and thus the labour of nearly $1\frac{1}{2}$ years had to be sacrificed, the cost of the working plan having amounted to Rs. 16,000. The work was subsequently ordered to be taken up by the District Forest Officer, but for various reasons it was shelved until 1924, when Mr. George Venugopal, the District Forest Officer, with commendable energy, prepared a working plan, which however did not receive the sanction of the Chief Conservator as it was found defective in parts. It was however approved as a temporary scheme for three years during which time the District Forest Officer was ordered to revise it, in accordance with the Chief Conservator's orders on the subject. Nothing more seems to have been done till 1930, when a second working plan was prepared by Mr. B. J. Singh, then District Forest Officer. This plan also was found defective and the present Working Plans Officer was appointed on the 22nd November 1931 to prepare a working plan for all the reserves of the division. At the time of writing, Mr. George Venugopal's plan is still current in the division.

(2) The Development Branch (1920–25).

167. *General.*—Mr. P. M. Lushington visited the division in 1919 in order to ascertain whether the evergreen forests at Kannikatty and Kodamadi would fit in with Mr. A. W. Lushington's scheme for supplying wood to Europe for re-building the areas in France and Belgium devastated by the Great European War, 1914–1918. The original idea was to supply only soft woods and the removal of these soft woods for which a sale could not be found in India had an irresistable appeal to all Forest officers who had to deal with evergreen forests. The utilization and proper treatment of these forests had exercised the minds of many Forest officers previously. Their comparative inaccessibility, the presence of only a few saleable species scattered over the forest among hundreds of unsaleable stems, the lack of knowledge of the silviculture of most of the species, and the undoubted value of shola forest as a protection to catchment areas, all operated as powerful factors in favour of leaving these forests unworked. Opinion was veering round to the belief that the proper method of management of these forests was not merely to remove the good species but also to attempt to get rid of the useless ones. Later years showed the necessity for not only getting rid of the useless species, but also keeping valuable trees, overmature though they might be, in order to foster the regeneration of the better species. In this direction Mr. D. T. Barry did excellent work over small areas at Kannikatty and Kodamadi in raising, by a modification of the shelter wood system, even aged crops of *Hopea* and *Balanocarpus*. He accomplished this by the girdling of valueless species overtopping such regeneration. Valuable though this work was, it was open to

criticism on the score that it was unjustifiably expensive owing largely to the fact that the girdled trees could not be sold, and that they were liable to fall and damage useful regeneration which could not be raised again by cutting back, owing to the feeble coppicing powers of most of the evergreens. Further the scale operated upon was small, and whether or not success could have been obtained with larger scale experiments was problematical.

Mr. A. W. Lushington's proposal to work these forests by making a clean sweep of existing growth and replanting with suitable species, revolutionary though it sounds, was not considered impracticable although little was known of the technique of raising plantations of evergreens at the time. Sample enumerations conducted in fairly representative forest at Kodamadi and Kannikatty gave the following astonishing results, all trees below 18 inches in diameter being excluded :—

Timber yield per acre.

	Tons.
Kodamadi (average type)	49
Kannikatti (do.)	76
Kannikatty (good type)	167

N.B.—The form factor was assumed to be 0·50 and 50 cubic feet was considered as equivalent to one ton.

In addition to this the small wood and branch wood out-turn which could be converted into fuel or charcoal was expected to double the yield.

168. *Mr. Lushington's proposals.*—Mr. P. M. Lushington therefore advanced the following proposals :—

(1) the construction of an electric tramway of about 20 miles from Ambasamudram to Kodamadi;

(2) the erection of a saw mill and pulp mill at Kodamadi; and

(3) the construction of a bridge across the Serviar at Mundanthorai wide enough to take both road and train traffic.

The electricity for power was to be obtained from the 600–ft. water fall at Kuttalam kalaruvi. Estimating the fuel demand in the division to be in the vicinity of 200,000 tons per annum, he anticipated no difficulty about the marketing of the fuel obtained from the annual evergreen coupe, at a profit.

His proposals for regeneration were—

(1) On the lower slopes the introduction of teak with an evergreen undergrowth of *Hopea* in suitable places, while in others, mixtures of *Hopea, Balanocarpus, Cedrela toona, Vitex altissima, Filicium decipiens;* and

(2) above 2,500 feet, where the true evergreens came in, *Gluta travancorica, Mesua ferrea, Dysoxylon malabaricum, Diospyros assimilis* and *Aglaia roxburghiana* were to be introduced.

169. *Investigation of the project.*—The result of these proposals was that an investigation into the project by the newly constituted Forest Engineering Branch was ordered by the Chief Conservator in his Proceedings No. 71, dated 15th September 1920, as it was considered that the exploitation of the forests on the scale proposed was more a problem for the engineer than for the forest officer. The immediate attention of the department was to be concentrated on obtaining exact information as to the extent and the yield of the shola forests and on ascertaining by experiment the best method of regenerating them. The first desideratum was to make the forests accessible by the construction of a network of bridle paths, on a gradient which would make their ultimate conversion into cart-tracts an easy matter. In addition, rest-houses and coolie lines were to be constructed at central positions so that both labour and the staff could be comfortably housed when doing work in these inhospitable regions. It was accordingly proposed to subdivide the Ambasamudram Range into two ranges, Kannikatty and Kodamadi, and also to provide a special officer to be in charge of the development of communications in, and the stock mapping of, the evergreen sholas in the new ranges.

170. *Estimated yields.*—Mr. Lemos was accordingly appointed as special officer and he roughly stock-mapped nearly 65 square miles of evergreen forest into the following classes :—

Type—

A. Pure evergreen	20 square miles.
B. Semi evergreen	10 ,, ,,
C. Deciduous	2 ,, ,,
D. Reed area with a sprinkling of tree growth	33 ,, ,,

Types A and B alone were considered exploitable, and enumerations carried out *along some of the paths*, over an aggregate area of 228 acres, by him gave the following averages :—

	Timber per acre.	Fuel per acre.
	TONS.	TONS.
Type A—		
Kannikatty	109·60	109·06
Kodamadi	92·09	92·09
Average ...	100·57	100·57
Type B—		
Kannikatty	43·00	43·00
Kodamadi	63·22	63·22
Average ...	53·11	53·11

N.B.—In considering the volume of marketable timber no account was taken of trees below 5 feet girth; only the length of clear bole was used for height data, and a form factor of 0·5 was applied to the result to allow for taper of the stem. Fifty cubic feet was assumed to be a ton and the quantity of fuel was assumed on empirical grounds to equal in weight the quantity of timber.

Thus the average yield in Type A forest was estimated to be 100 tons of timber and 100 tons of fuel per acre, and in Type B forest, about 50 tons of timber and 50 tons of fuel per acre.

171. *Estimated revenue and expenditure.*—The following interesting estimate of the capital value of the forest was thus arrived at :—

	Timber tons.	Fuel tons.
20 square miles of Type A forest would yield ...	1,280,000	1,280,000
10 square miles of Type B forest would yield ...	320,000	320,000
Total ...	1,600,000	1,600,000

Valuing the timber at 8 annas per cubic foot or Rs. 25 per ton of 50 cubic feet and fuel at 4 annas per ton the timber stock was estimated to be worth 40 million rupees and the fuel 4 lakhs. These estimates are shown, by the more detailed enumerations undertaken during the preparation of this working plan, to have been far too optimistic. It is not surprising however that the calculations outlined above led the Chief Forest Engineer, Mr. Martin, an expert on American logging methods, to propose a large scheme to be financed on a direct development loan. The project was to consist of a railway from Ambur on the plains to Mundanthorai and ultimately to Kodamadi; an investment in the latest logging machinery, flumes, ropeways, tractors, etc., and the erection of a saw mill at Mundanthorai. For this purpose he proposed the following capital outlay :—

	RS.
Railway plank	16,85,000
Logging machinery	2,00,000
Buildings, roads and flumes	1,00,000
Saw mill	5,00,000
Contingencies	15,000
Total ...	25,00,000

The annual return on investment was estimated to be—

	RS.
Fuel	60,000
Timber	4,00,000
Saw mill	2,00,000
Charcoal and by-products	15,000
Total ...	6,75,000

Or a return of about 27 per cent on the outlay. Sanguine as Mr. Martin was, however, he fortunately realized the need for the collection of more complete data and the preparation of detailed estimates based on actual surveys and enumerations, before proceeding further with the scheme.

172. *Tentative decisions.*—Meanwhile the task of opening up the forests and carrying out enumerations of the growing stock proceeded apace under the special staff sanctioned. By 1923, 75 miles of inspection paths had been constructed and 50 per cent enumerations conducted over a total area of 2,640 acres. In 1927 as a result of a joint inspection of the evergreen forests by the Chief Conservator, the Territorial Conservator and the Working Plans Conservator, the following tentative conclusions as to the best method of treatment were arrived at :—

(*a*) to make revenue by selection fellings and hand sawing of railway sleepers and kolmarams (scantlings) ;

(*b*) to tend, especially by climber cutting, such advance growth as was present, and very gradually to open the cover by fellings which were to vary in degree from place to place according to the size and state of the advance growth present ; and

(*c*) to attempt to increase the proportion of valuable species by planting where the advance growth was insufficient.

Accordingly a special officer was appointed to work under the direct orders of the District Forest Officer and under the supervision of the Working Plans and Territorial Conservators. He was ordered to select an area of not more than 100 acres in the *Mesua* zone at Kannikatty and conduct light selection fellings in it, with a girth limit of 7 feet. The felled trees were to be hand sawn, the *Mesua* into sleepers and the other species into appropriate-sized scantlings, which could be manhandled to the nearest cart-track. Careful statistics of cost and revenue were to be kept. Climbers in the area were to be cut and advance growth of valuable species tended by giving it the requisite light. A nursery of the more valuable evergreen species was to be formed and plants from it were to be underplanted where advance growth was absent or insufficient. Direct sowing of seeds of valuable evergreen species in demarcated plots was also to be tried, the seeds for the purpose being collected from selected mother trees.

173. *Exploitation.*—In 1928, the first evergreen coupe of 61 acres at Kannikatty was worked departmentally. Some 8,000 cubic feet of timber was extracted at a total cost of Rs. 8,990 excluding overheads and a net revenue of Rs. 440 or about Rs. 7–3–0 per acre obtained. The following table shows the results of departmental working :—

Coupe number.	I	I	I	II	III
Year of working … …	1928	1929	1930	1930	1931
Area worked in acres …	51	—	—	45·5	30
Number of trees marked.	153	—	—	108	75
Number of trees converted.	132	9	9	96	67
Number of *Mesua ferrea* …	35	3	6	24	32
Number of other species …	97	6	3	72	35
Gross yield in cubic feet.					
(*a*) *Mesua ferrea* … …	3,370	241	523	1,632	2,176
(*b*) Other species … …	11,729	726	322	7,396	5,073
Net yield in cubic feet.					
(*a*) *Mesua ferrea* … …	1,365	91	200	940	2,017
(*b*) Average outturn per tree.	39	30	33	39	63
(*c*) Other species … …	6,633	395	74	4,690	4,684
(*d*) Average outturn per tree.	68	66	25	65	134
(*e*) Average net yield per acre of all species in cubic feet … …	—	143	—	124	223
		RS.	RS.	RS.	RS.
Total cost of extraction … …		8,947	413	5,402	6,361
Total revenue … … … …		9,025	526	7,932	8,493
Net profit … … … … …		78	113	2,530	3,132
			RS. A. P.	RS. A. P.	RS. A. P.
Net profit per acre exploited … … …			3 12 0	45 9 0	71 1 0
Net profit per tree exploited … … …			1 6 0	24 1 0	31 13 0

Exploitation in 1928 and 1929 was carried out by the special officer Mr. Kesava Vittal while from 1930 onwards all operations were conducted by the district staff. The great disparity in the net revenue obtained under the different managements was partially due to the fact that in the earlier years the exploitation work had to be newly organized and hence higher rates had to be paid.

174. *Conclusions.*—The results of departmental operations showed that extraction could be undertaken at a profit which would more than cover the cost of regeneration operations. Silviculturally it demonstrated that it was not desirable to fell more than three trees on any one acre, as heavier felling made too big gaps in the canopy, which was not conducive to the preservation of the essential character of these evergreen forests. It must be added however that the coupes were carefully selected so as to include the very best areas only.

175. *Contract agency.*—The success of departmental working encouraged local contractors in 1932 to come forward and purchase standing trees in the annual coupe, but the bids, as was to be expected in a new enterprise like this, were disappointing. The results of working through contract agency are given below :—

Locality of working.	Year.	Coupe.	Area in acres.	Number of trees marked.	Price obtained RS.
Kannikatty	1932	IV	57	151	800
Kodamadi	,,	I	47	159	1,300
Sengalteri	,,	I	33	100	725
Kannikatty	1933	V	66	138	862½

This works out to an average revenue of Rs. 18–12–0 per acre and Rs. 6–11–0 per tree sold. Until the working of the evergreen forests is better understood locally it is idle to expect better prices, as competition is at present strictly limited to two or three timber merchants. A great deal in the way of popularising the work by improving communications, diminishing unnecessary friction between the contractor and the subordinate staff, and assisting the contractor as far as possible both by giving him professional advice and by promoting the sale of his produce, can be done by the District Forest Officer if he is really interested. It is essential that he should take a personal interest in a new departure such as this is, if it is to be made a success.

176. *Grazing fees.*—The need for reducing the grazing incidence by enhancing the grazing fees from 3 annas to 8 annas a cow unit in the interests of forest conservation was first felt early in 1916. The dates from which the enhanced fees came into force in the various ranges are given below :—

(*g*) *Grazing.*

Name of Ranges and Authority.

Kuttalam, B.P. No. 148, Mis., dated 9th May 1917.
Nanguneri, B.P. No. 242, Mis., dated 20th June 1918.
Ambasamudram, B.P. No. 273, Mis., dated 9th June 1919.
Srivilliputtur, Chief Conservator's Proceedings Mis. No. 221, dated 27th July 1921.
Srivaikuntam, G.O. No. 1993, Mis., Development, dated 30th October 1930.

177. *Superior staff.*—The District Forest Officers of the period under review were—

Name.	From.	To.
Mr. D. T. Barry ...	17— 9—1915	4— 4—1917
,, H. W. Woodhouse Adolphus	5— 4—1917	10— 5—1917
,, D. T. Barry ...	11— 5—1917	17—10—1917
,, Md. Habibullah	18—10—1917	26—10—1917
,, D. T. Barry ...	27—10—1917	10— 4—1918
,, G. C. Robinson	11— 4—1918	4— 5—1918
,, D. T. Barry ...	5— 5—1918	1— 9—1918
,, A. B. Jackson	2— 9—1918	7—11—1918
,, D. T. Barry ...	8—11—1918	15— 8—1919
,, T. Clear ...	16— 8—1919	21— 9—1919
,, S. V. Devadasan ...	22— 9—1919	22—10—1919
,, W. C. Hart ...	23—10—1919	31—10—1920
,, D. T. Barry	1—11—1920	17— 5—1921
,, George Venugopal ...	18— 5—1921	28— 6—1923
,, A. Hanumanta Rao	22— 6—1923	28— 9—1923
,, George Venugopal	29— 9—1923	11—10—1925
,, E. M. Crothers	12—10—1925	10— 6—1926
,, B. J. Singh	11— 6—1926	15—10—1926
,, J. H. Longrigg	16—10—1926	26— 7—1928
,, N. Trimurthi	27— 7—1928	2— 4—1929
,, H. G. Hicks	3— 4—1929	4—11—1929
,, B. J. Singh	5—11—1929	20— 5—1932
,, E. A. Lasrado	21— 3—1932	20— 6—1932
,, B. J. Singh ...	21— 6—1932	14— 7—1932
,, A. A. Khan	15— 7—1932	26— 2—1933
,, E. V. Padmanabha Pillai	27— 2—1933	

SECTION 2.—PAST SYSTEMS OF MANAGEMENT AND THEIR RESULTS.

178. *General.*—In the previous section, the general outline of the history has been dealt with by periods, such a procedure being found most convenient. In this section it is proposed to discuss the past treatment of the forest, the reasons for it and its results.

A. Fuel Forests.

179. *Method of treatment.*—Two systems of management were applied to these forests : " the simple coppice " system to those areas on which the nature of the soil and the growth was not conducive to the production of anything but fuel, and a modified " coppice with standard " system where conditions were favourable for the production of both fuel and small timber.

180. *The simple coppice system.*—This system applies to the following areas :—

Range.	Name of fuel series.	Area in acres.	Year of starting.	Period of first rotation.	Period of second rotation.
Srivilliputtur ...	Pudupatti	1,978·00	1903	20	30
	Valaikulam	1,519·00	1896	20	30
	Rengarkoil	1,791·00	1896	20	30
Ambasamudram.	Ambur	1,867·00	1897	20	30
	Koriar	1,540·00	1925	—	30
Nanguneri ...	Kolundamamalai ...	627·00	1924	—	30
	Terku Viravanallur ...	859·00	1924	—	30
	Manpothai	637·00	1922	—	30
	Padmaneri	620·00	1924	—	30
	Malayadipudur ...	612·00	1924	—	30
	Parivarisurian ...	1,012·00	1925	—	30
	Vallanad	1,553·00	1924	—	30

181. *Rotation.*—It will be seen that although the rotation was originally 20 years, it became apparent at the end of the first period that this was insufficient as the crop on these dry and infertile soils was not mature enough for felling at the end of the 20 years period. Fresh areas has therefore to be added to all the old felling series with a view to increasing the rotation to 25 to 30 years, without at the same time decreasing the size of the annual coupe. All the new felling series constituted under Mr. Venugopal's working plan were allotted a rotation of 30 years.

182. *Regeneration.*—Thirty years and more of coppice working in the division has brought coppice felling to a high state of perfection. Not even the most meticulous can find anything to cavil at in the coppicing of tree stumps as carried out in the division. During the course of inspection however it has been frequently noticed that felling and coppicing are often not carried out *simultaneously*. If coppicing is carried out some time after felling, a second shock to the stump is communicated and budding coppice shoots are frequently destroyed and a definite decrease in the coppicing power of the stool results. Where weed growth is fierce, it is especially desirable that the coppice shoots obtain as good a start as possible over the weeds and this can only be accomplished by coppicing the stump as soon as the tree is felled. Fortunately most of the species found in this type of forest provide excellent coppice shoots, the suppression by weeds and creepers noticed in the first few years after felling being more apparent than real. *Strobilanthes* is the one weed which is really dangerous. Being of gregarious and rapid growth it swamps newly felled areas rapidly and completely, and its dense shade is particularly destructive to natural seedling growth of the more light demanding species such as teak. Its complete eradication from newly felled areas is therefore an urgent necessity.

Natural seedling regeneration of the more important fuel species in these areas is the exception rather than the rule. It is perhaps the case that the germinative capacity of seed from young coppice is lower than that from old trees. If so, this may account for the death of natural regeneration. A small experiment with *Albizzia amara* in Srivilliputtur range showed that whereas the germinative capacity of seed from 15-year old coppice was 22 per cent that from old trees outside the fuel series was 41 per cent (200 seeds of each were tried). Again in the majority of these fuel series the surface soil is so hard, the terrain so comparatively steep and the rainfall so ill-distributed, that seed does not usually germinate readily; even if it does the seedling is either washed away by rain or fails to survive the first drought. This is the chief reason why even those of the fuel series which are in their second rotation, are far from being normally stocked. The necessity for artificial regeneration of the fuel coupes is therefore pressing.

Attempts at such work have been made in the past. Individual District Forest Officers from time to time have been impressed by the necessity for it; control journals give details as to the quantity and kinds of seed sown in various fuel coupes. Seed

collection on a large scale, in all the ranges of the division appears to have been the regular practice from about 1907 to 1912, the following figures for 1910 being characteristic :—

	Name of range.				
	Srivilli-puttur.	Kutta-lam.	Amba-samudram.	Nangu-neri.	Tinne-velly.
Teak	807	610	240	460	...
Albizzia lebbek	232	5	39	131	273
Pterocarpus marsupium ...	219	112	126	358	...
Albizzia amara	40	...	...	...	...
Acacia leucophlœa ...	50	...	...	...	...
Acacia arabica	...	...	...	14	394
Acacia planifrons	61	...	...	...	375
Zizhyphus trinervia ...	4	...	...	...	...
Anogeissus latifolia ...	82	1	14	14	...
Terminalia chebula ...	46	...	...	...	...
Butea frondosa	134	...	...	...	...
Cassia auriculata ...	11	1	3	45	139
Tamarind	157	33	37	26	35
Melia azadarachta ...	227	34	82	79	513
Pongamia glabra	15	...	...	1	...
Acacia sundra	2	...	...	...	...
Rosewood	22	...	8	...	...
Dalbergia multiflora ...	22	...	...	...	135
Terminalia paniculata ...	...	50	...	...	...
Dolichandrone crispa ...	...	12	...	...	...
Chloroxylon swietenia ...	...	4	...	...	...
Eugenia sp.	...	4	88	47	...
Nepheluim longanum ...	...	3	...	...	...
Dodonea viscosa	...	5	...	...	13
Mundulea suberosa ...	...	2	...	...	...
Cassia fistula	...	...	2	...	...
Mahogany	...	...	5	...	...
Zizyphus jujuba	...	...	...	...	45
Odina wodier	...	...	...	...	49

N.B.—Quantities are in Madras measures.

These comparatively large quantity of seed must have been dibbled in the various fuel coupes. Information as to the method of sowing is meagre, but a perusal of available records goes to show that the seed was dibbled in lines 10 feet apart in *blanks* over the whole annual coupe just before the monsoon. Most of the coupe numbers have been changed since and all old maps destroyed; hence the result of such dibblings cannot be assessed now with any degree of certainty. It may be concluded, however, from the remarks in Mr. P. M. Lushington's inspection note of 1915 that sufficient care was not taken to keep the lines open until the plants got their heads above the undergrowth, with the result that much of the seedling growth was destroyed by suppression.

Finally the closure of fuel coupes to grazing for a period of five years after felling has not been found sufficient to conserve natural and artificial seedling growth owing to the slow rate of growth in these dry and infertile areas.

183. *Conclusions.*—To summarize, the simple coppice system is ideally suited to the areas to which it is applied at present, as it not only ensures the reproduction of the original forest, but also on a comparatively short rotation of 30 years, ensures the maximum sustained yield per acre which can be obtained from this type of forest. The one essential in order to obtain normal stocking, is to supplement the natural coppice regrowth where necessary by artificial means, which are likely to be cheap and efficient. Past work on these lines has not been conducted in a systematic manner. Neither the cost per acre nor the results can be accurately assessed. It is therefore necessary to devise a method which will not only be comparatively inexpensive but also be susceptible of a high degree of control.

184. *The coppice with standard system.*—This system as practised in the division owned its inception to the fact that at the time of reservation, the forests were in such a degraded state, that the first desideratum was felt to be the improvement of the growing stock. In the earliest " coupes " therefore the felling partook more of the nature of an improvement felling, only overmature, unsound, useless and crooked trees being felled and coppiced and the bulk of the better grown trees being retained. Gradually with the increasing demand for revenue to cover expenditure, it became necessary to fell a certain percentage of the sound trees also, in order that the value of the coupe might be enhanced. As working plans came to be prepared it was found necessary to devise a name for this system of management, and its similarity to the European " coppice with standard " system resulted in the adoption of this name. The system as locally practised however differs from the true " coppice with standard " system, in that, in the former, no standard rotation is prescribed. The aggregate average annual area felled under the " coppice with standard " system in the division amounts to 1,200 acres. " Not less than 20 nor more than 25 trees of the better species " are prescribed to be retained as standards. This means that from 24,000 to 30,000 standards are annually to

be marked. The task of measuring and marking this large number of standards is often delegated to the lower subordinates and the results have in the recent past not been satisfactory. The Range Officers' activities are usually restricted to checking 10 per cent of the marking.

185. *Defects of the system.*—The following table shows the present position of "coppice with standard" working in the division.

Name of series.	Area.	Year of starting.	Period of first rotation.	Period of second rotation.
Srivilliputtur Range—				
Ayyanarkoil	5,065·0	1896	20	32
Kuttalam Range—				
Vasudevanallur	2,961·0	1898	20	25
Karuppasamikoil	2,946·0	1898	20	25
Puliangudi	2,748·0	1908	30	29
Kadayanallur	1,901·0	1898	20	26
Panpuli	1,654·0	1907	...	26
Kuttalam	2,700·0	1897	20	26
Ambasamudram Range—				
Padaramalai	3,929·0	1895	20	30
Koilteri	2,901·0	1897	20	30
Nanguneri Range—				
Kalakad	4,353·0	1896	18	30
Vadagarai	2,200·0	1918	...	30
Tirukurangudi	1,189·0	1902	18	27

(1) Owing to the short rotation under which the older series were worked in the past, and also probably to defective standard marking, the task of selecting the required number of standards (20–25) per acre is now sometimes impossible. The result is a very uneven distribution of standards over the felled coupe, standards being congested on good areas and very scattered on poor areas. First rotation standards are seldom, if ever, retained, presumably because it is anticipated that the revenue will suffer thereby. The following table shows the average number of standards retained over the whole "coppice with standard" annual coupe for the three years 1929 to 1931.

Year.	Area of annual coupe.	Number of standards marked.	Average number of standards per acre.
1929	1,176	22,022	18·7
1930	1,210	20,358	16·8
1931	1,293	22,242	17·2

It will be noted that the average is lower than the minimum of 20 standards prescribed to be retained.

(2) Standards are frequently damaged during fellings or are stolen by contractors. Many standards owing to their sudden isolation in the coupe are blown down or badly broken by wind. The contractor is compelled to pay the *value* of all wind fallen standards and in addition is fined to the extent of three to five times the *value*, according to the discretion of the District Forest Officer, for all standards illicitly removed or damaged in felling during the currency of the contract. The *value* of the standard has been fixed somewhat arbitrarily on the following scale :—

Class	Dimension - diameter.	Teak and Rosewood. RS. A. P.	Other species. RS. A. P.
	INCH. INCH.		
I	below 4	0 8 0	0 2 0
II	4 to 8	1 0 0	0 4 0
III	8 to 12	2 0 0	0 8 0
IV	12 to 16	4 0 0	1 0 0
V	16 to 20	8 0 0	2 0 0

To penalize the contractor for windfalls, which are due often to defective marking, would seem to be a mistake. Further the system of fining him for damaged or missing standards has been a frequent cause of friction between the contractor and the department. That the fines so collected are by no means insignificant is clear from the following table :—

Year.	Number of damaged.	Standards missing.	Wind-fallen.	Fines as value.	Recovered as penalty.
1. 1923	571	1,377	...	...	1,089
2. 1924	1,017	1,837	477	804	510
3. 1925	868	1,476	192	648	1,209
4. 1926	730	1,444	567	525	1,489
5. 1927	724	1,510	838	842	565
6. 1928	397	1,285	349	357	1,598
7. 1929	205	320	319	221	684
8. 1930	671	580	378	204	535
9. 1931	406	540	311	205	505
Total ...	5,248	10,369	3,431	3.806	8,184

The fine collected averages Rs. 1,332 per annum, the fall in recent years being attributable to a greater laxity in the checking rather than to an improvement in working.

(3) Again the rainfall, soil and climate prevailing in most of our coppice with standard fuel series are not conducive to the development of big timber. Any one who has seen the indigenous teak will almost be inclined, at first sight to doubt whether it is the same species as that present in its natural home on the West Coast. Biologically the species are identical but the strain present in Tinnevelly is enormously inferior, girths above 4 feet and a height growth above 35 feet being the exception rather than the rule. Under these circumstances the folly of trying to grow timber of large dimensions, by a proper application of the *true* coppice with standard system is patent. The local demand for the slow grown teak of the division is however undoubtedly great. Teak below 25 inches girth sells at about 4½ annas per cubic foot while between 25 inches and 40 inches girth its price is 10 annas per cubic foot. There is thus a great price increment in the value of teak once the 25 inches girth limit is passed, and the object of management should be to produce as many poles above 25 inches girth as possible.

(4) Mr. George Venugopal in his tentative working plan stated " the chief object of the standards, is to give seed; mature trees should be retained as standards and *these need not necessarily be the best.* It has been found from past experience that straight poles of smaller dimensions are blown down by wind soon after they are exposed and straight poles of larger dimensions are often stolen during the course of the rotation so that the object for which standards are retained is defeated. If mature trees, not necessarily straight ones, are retained as standards they not only give more seed, but will remain till the end of the rotation, when such of them which will not survive for another rotation may be removed and their number supplemented by others." Seemingly the retention of only such mature trees as would not arouse the cupidity of the contractor was prescribed. In addition, this working plan prescribed the retention of saplings of the *better species* of 9 inches girth and below *at the base.* The object of this is not apparent. There is little doubt however that such prescriptions resulted in the retention of only small trees and hence havoc by wind damage was correspondingly great. Besides, the main object of the coppice with standard system, which is the production of timber trees of small timber dimensions could not be attained.

(5) Finally the retention as standards of species other than timber species, such as teak, *Pterocarpus marsupium*, rosewood and *Terminalia paniculata* would seem to be a mistake. At present even fuel species such as various *Acacias, Aglaias and Bauhinias* are so reserved.

186. *Conclusions.*—For all the reasons enumerated above it seems desirable to replace the " coppice with standard " by the " simple coppice ", system with artificial regeneration of sparsely stocked areas combined with adequate fire protection and closure to grazing of at least the ten youngest coupes. With a view to ensuring the supply of small timber, especially teak, the rotation, in such of the present coppice with standard fuel series as are capable of growing trees of small timber dimensions within economic limits, will have to be raised.

187. *Advantages of the simple coppice system.*—Briefly stated the advantages of this system are :—

(1) If coppicing is done properly it is generally acknowledged that the resulting coppice shoots soon develop an independent root system of their own. The whole forest is thus renewed at every rotation.

(2) The system is considerably easier to work through contract agency, the restrictions imposed on the contractor being fewer and the opportunities for his oppression by venal subordinates being considerably reduced.

(3) Unlike the coppice with standard system which can be successfully applied only to more or less homogenous crops, where the underwood species is shade bearing and the over wood species light demanding, the simple coppice system is of more universal application, and more suited to conditions in the local deciduous forests where there are over fifty different species, most of them being light demanders.

(4) Under the coppice with standard system there is a grave danger that the standards may become too old to produce vigorous coppice shoots. Thus the natural stocking of the forest will tend to decrease progressively. Again the retention

of standards of any size means a definite loss of increment in the coppice crop coming up under their shade. These defects are not present in the simple coppice system.

188. *Natural regeneration.*—In both the "coppice with standard" and "simple coppice" fuel series, natural coppice regeneration is good. In the former however, coppice regrowth of light demanders such as teak, in the vicinity of standards, suffers to an appreciable extent from drip and shade. Natural regeneration from seed is excellent during the monsoons, but generally dies back annually owing to excessive drought or suppression by weed growth, until ultimately a strong root system is developed, when given a favourable monsoon, the seedling shoots up and establishes itself. Teak and *Pterocarpus marsupium* especially behave in this manner. Seedlings of the latter with an extremely thick root collar showing from 10 to 20 annual rings, are a common feature in the forest. The period of establishment of seedling regeneration is therefore unduly long and with a view to obtaining normal stocking as quickly as possible, artificial regeneration is necessary.

189. *Artificial regeneration.*—There is little on record to show what exactly was done in this respect in the fuel coupes in the past. Mr. Richmond in 1903 first started sowing teak, rosewood and *Pterocarpus marsupium* in blanks, in the annual coupe of the Kuttalam Felling Series; further from the presence of *Stercospermum* and *Albizzia* poles in this series, it may be presumed that these species were also introduced at the time, as they are not found in the adjacent unworked forest. This work was subsequently extended to most of the annual coupes worked under the coppice with standard system. The general method appears to have been to sow seeds of timber species in lines 10 feet apart. In the absence of subsequent tending, the seed lines were covered with grass and weeds and the operations were largely failures. Mr. P. M. Lushington in his inspection note on the division in 1915 says "cultural operations have been carried out on a considerable scale round Mundanthorai, and have undoubtedly shown some success with teak but I have not found any of the other species put down except as young plants. Here want of success is due to want of tending in subsequent years." He accordingly ordered that these operations should be stopped as a whole, but advised the concentration of effort on *one* definite area, of large size, near Mundanthorai, so that accurate data of costs and results could be obtained, with a view to deciding whether the work was worth continuing. Accordingly lines 15 feet apart were cleared and seeds of *Pterocarpus marsupium*, *Hardwickia binata* and *Pongamia glabra* were dibbled on prepared mounds 1 foot high near Mundanthorai. The result was a failure, though why teak was not tried is not apparent. Mr. Barry, in 1921, remarked "since 1904 attempts at sowing and dibbling seed have been made in the felled coupes of most working circles, year after year with practically no result." The probable reasons for this continued failure are :—

(1) Most of the dibbling according to the control journals was done in June, i.e., after the burst of the south-west monsoon. It was only to be expected that the germinated seedlings could not survive the long break which usually follows the first burst of this monsoon. Dibbling is likely to be more successful if completed by the end of April.

(2) Suppression by weeds, grass and strobilanthes (*Stenosiphonium russellianum*) was partially responsible for heavy casualties. Some method of diminishing weed growth is indicated.

(3) The operations seem to have been carried out on too large a scale to admit of effective supervision. For instance, 24½ miles of seed lines were dibbled in old Coupe XX of Kalakad Series and 105 acres dibbled in Coupe XXI of the same series.

190. *Strobilanthes.*—The damage done by strobilanthes to young regeneration both natural and artificial is very great. On the Mundanthorai plateau attempts were made in 1921 to eradicate it. One hundred and fifteen bundles were collected at a cost of 1 anna per head load. Transport to Ambasamudram cost 2 annas and the sale price was 5 annas. Thus a net profit of 2 annas per headload was secured. Later collection by coolies on payment of a seigniorage of 6 pies per head load was permitted and there was a brisk demand at this rate. The system was not continued, however, owing probably to the discovery that cutting back of strobilanthes had no effect on its subsequent growth.

Four 1-acre plots were laid out at Mundanthorai in the Padaramalai Felling Series in September 1921 in the following manner :—

Plot I.—Green strobilanthes was cut close to ground level at a cost of Rs. 7–5–0 per acre.

Plot II.—Flowering and drying strobilanthes was cut flush with the ground at a cost of Rs. 10–2–0 per acre.

Plot III.—The green weed was cut 1½ to 2 feet above ground level at a cost of Rs. 7–8–0 per acre.

Plot IV.—The dead and dying weed was cut and burnt at a cost of Rs. 4–8–0 per acre.

In May 1922 the plot was inspected by the District Forest Officer who remarked :—
"The experiment has shown that cutting the weed 1½ to 2 feet above ground level is useless as the growth is as dense as it originally was."

Plot III was therefore abandoned. As a result of further inspection in December 1922, it was observed that the strobilanthes in Plots I, II and IV was almost as dense as it originally was, and that even in the burnt area, Plot IV regeneration of the weed was plentiful. The problem of eradication seems therefore unsolvable. Since it can be sold at a profit, it appears to be worth while trying experimentally the result of annual cutting of strobilanthes. An experiment on these lines in the Padaramalai Felling Series will accordingly be prescribed.

B. Timber.

191. *Evergreen timber working.*—The earliest working of the evergreen forests in the division seems to have occurred between 1888 and 1896 in the sholas of Srivilliputtur Range. The method adopted was to allow a contractor to fell principally *Vitex altissima*, *Filicium decipiens*, *Litsœa zeylanica* and *Mesua ferrea* in the shola forests in the Chittar valley and convert them into small scantlings (spokes, plough poles, etc.), which could be man handled down to the plains. Similar work was carried on in the sholas in Nanguneri Range from 1897 to 1901, *Palaquium ellipticum*, *Mesua ferrea* and *Bischofia javanica* being extracted. The contractor paid on the quantity of timber that he actually removed to the depot in the plains. In the absence of supervision of fellings and owing to the fact that conversion was effected by the axe, much wastage was involved and the system was abandoned. Mr. Richmond remarked in 1903 that under this system "a contract for a certain number of cubic feet was given to a contractor who was at liberty to take them from *anywhere* he liked, and moreover if he cut down a tree and found it did not quite suit him, he worked on and cut down another and so on. It did not matter to him how many trees he destroyed as he only paid on the number of cubic feet he removed. Anything more wasteful it would be difficult to imagine."

The next system tried was to sell marked trees standing in located areas. The felling cycle was six years and each working circle was therefore divided into 6 coupes. The following working circles were constituted :—

—	Total area.	Felling cycle in years.	Girth limit at breast height.	Average annual possibility in trees.	Year of starting.
Srivilliputtur Range.					
Mylai Working Circle	705	6	6′	50	1903
Vellakalteri Working Circle	1,810	6	4½′	20	Do.
Nanguneri Range.					
Karumandiamman Working Circle ...	2,235	6	7′	200	1903

The trees were to be selected and marked prior to felling and sold standing; payment was to be made in lump sum for all trees standing and not calculated on the outturn. The following table for the Karumandiamman Shola Working Circle shows the results of working :—

—	Area in acres.	Possi-bility trees.	Actually extracted trees.	Revenue.
Coupes I and II	438	400	210	436
Coupe III	280	200	141	426
Coupe IV	561	200	43	160
Coupe V	410	200	83	314
Coupe VI	499	200	60	536

It is obvious that the possibility was fixed too high as sufficient trees above the prescribed girth limit could not be found on the area. The revenue works out to As. 13–8 per acre or Rs. 3–7–6 per tree felled. Details of working for the other working circles are not available. As early as 1904 Mr. Richmond had remarked "I do not think the system is a good one as it tends to favour bad species—which are not cut—unless the greatest care is taken in the selection of the trees to be felled, none being marked except those surrounded by or standing over a well-established advance growth of the same or other valuable species." Again, the prescription that as little damage as possible should be done to the surrounding forest during felling could not be successfully carried out. In view of the importance of these sholas as protectors of the catchment areas of the more important irrigation streams, the possibility of destroying them by

exploitation could not be contemplated, and in Board's Proceedings Forest No. 512, Miscellaneous, dated 9th April 1913, all shola exploitation was ordered to be stopped. Considering that these sholas were fairly accessible and moderately stocked with saleable species of large dimensions, the discouraging financial results of working doubtless also influenced the above decision.

In Ambasamudram Range valuation surveys on representative areas had been carried out in the shola forest at Kannikatty and Kodamady as early as 1883, with a view to ascertaining the possibility of these forests. From 1886 to about 1896, an average of 6,000 cubic feet of *Hopea and Balanocarpus* were extracted annually from the Ullar, upper Serviar and Kuduvarai valleys, all extraction being done departmentallly the cost of extraction averaging As. 12–6 per cubic foot. That these operations involved considerable wastage can be concluded from the fact that of 152 trees felled in the Kuduvarai valley in 1899, only 28 were converted. Mr. Hooper accordingly ordered the stoppage of operations until the forests were adequately opened out and the demand stimulated, as he was convinced that a considerable amount of overfelling had been done in the past. After the construction of the Kodamady-Kuttalam-Kalaruvi road in 1909–10 extraction in the area west of the Usipothai saddle was attempted departmentally, but was soon abandoned as it did not prove lucrative. In 1910–11, 50 trees, principally *Vitex altissima*, were sold standing in this locality to a contractor at Rs. 5–8–0 per tree. In 1911–12 this system was again tried 50 trees again being sold at Rs. 6–8–0 per tree. The contractor must have made a good profit as an average nett yield of 150 cubic feet per tree was obtained, one *Hopea* tree alone yielding 317 cubic feet the selling rate for *Hopea* scantlings at the time being Rs. 3 a cubic foot. In spite of this, contractors in the succeeding year refrained from offering good prices at the sale, and it was decided that in order to realize the full value of the tree, departmental working was the only solution. As sawyers had to be imported from Travancore the risks of advances proving unrecoverable, together with other defects of departmental working, discouraged any adventure in this direction. All extraction was therefore suspended pending the preparation of a working plan which did not materialize for reasons referred to in paragraph 166 above.

192. *Defects of the system of working.*—The principal defects of the shola working alluded to above were that no attempts were made either to encourage what natural regeneration of the more valuable species there was on the ground, or to supplement such regeneration by artificial means where necessary. This was the problem which was to be solved before shola extraction was started again in 1928.

193. *Remedies.*—Three alternatives suggested themselves—

(1) the possibility of raising by the judicious girdling of inferior species, a sufficiency of regeneration of the valuable species in *advance* of felling so that the actual removal of the superior species would not materially effect the advance growth obtained. This was more or less the shelterwood compartment system modified to suit the needs of a forest with a large number of species, only a small proportion of which were valuable as timber;

(2) the feasibility of regenerating gaps caused by selection fellings, artificially with valuable species; and

(3) the desirability of tending such natural regeneration of the valuable species as existed over the whole of the annual coupe by cutting out inferior growth interfering with it, care being taken not to admit more light than would be necessary. Each of these alternatives will be discussed below.

194. *The securing of advance growth.*—Messrs. Latham and Peake between 1908 and 1912 had carried out various small scale experiments in opening up the canopy over young natural regeneration of *Balanocarpus*, *Gluta* and *Hopea*. This work was continued by Mr. Barry who, by judicious cutting or girdling of trees standing over natural regeneration of *Hopea* and *Balanocarpus*, and by broadcast sowing of large quantities of seed of these species, was able to raise even aged crops over small areas scattered over the forest. The so-called "*Balanocarpus* areas" behind the Kodamadi Rest-house. on the western face of Usipothai ridge, along the bridle path to Cox's Hut, and along the Kariar-Kannikatty road, were all the results of Mr. Barry's enthusiasm in this direction. These results encouraged the belief that large scale operations on similar lines would be equally successful, and accordingly it was decided in 1920 that the best method of exploiting the evergreens was to establish a mass of advance growth of the more valuable species about five years in advance of felling, so that when the felling of the overwood took place, sufficient even aged regeneration would remain undamaged to provide a new crop, potentially more valuable than the original crop. This object was to be attained by—

(*a*) the fostering of existing valuable natural regeneration and advance growth by a judicious and graduated opening of the canopy, by girdling or felling undesirable species;

(b) the cutting of all climber growth; and

(c) the supplementing of valuable natural regeneration where it was absent or insufficient by sowing or planting.

For this purpose the species were divided into three classes as shown below :—

Class A.

1. *Gluta travancorica.*
2. *Hopea parviflora.*
3. *Mesua ferrea.*
4. *Balanocarpus utilis.*
5. *Dysoxylum malabaricum.*
6. *Cedrela toona.*
7. *Artocarpus hirsuta.*
8. *Filicium decipiens.*
9. *Palaquium ellipticum.*

Class B.

1. *Vitex altissima.*
2. *Hardwickia pinnata.*

Class B—cont.

3. *Cullenia excelsa.*
4. *Aglaia roxburghiana.*
5. *Diospyros sp.*
6. *Eugenia sp.*
7. *Pygeum wightianum.*
8. *Pterospermum rubiginosum.*
9. *Garcinia sp.*
10. *Cinnamomum sp.*
11. *Canarium strictum.*

Class C.

All the remaining species.

The work done in the first year was—

(a) the cutting of climbers, and C class species below 18 inches in girth, and depositing the debris in lines 6–10 feet apart to facilitate subsequent sowing and planting operations;

(b) the transplanting of about three months old seedlings of A class species in lines over a portion of the area;

(c) the broad cast sowing of such seeds of A and B class species as were readily obtainable.

In the second year item (a) was repeated and in addition some C class trees between 18 inches and 24 inches girth were girdled to let in more light. The latter operation was not undertaken over the whole regeneration area as prescribed, because there was not sufficient regeneration on the ground to justify further opening up of the canopy. Sowing and planting was again done over as much of the area as needed it.

195. *Results.*—The results are abstracted below :—

Locality. (1)	Cost of felling C. class species. (2)	Dibbling and sowing number of measure of seeds. (3)		Planting (seedlings). (4)		Weeding. (5)	Cost columns (3), (4) and (5). (6) RS. A. P.	Total cost. (7) RS. A. P.
1 *Kannikatty*—								
1921–22 .. (81 acres)	652 6 6	*Balanocarpus* ..	60	*Hopea* ..	15,111	..	71 10 9	724 1 3
		Cedrela ..	16					
		Pygeum ..	50					
		Eugenia ..	28					
		Gluta ..	28					
1922–23 ..	44 14 0	*Mesua* ..	244	*Artocarpus hirsuta.*	571	9 8 0	213 7 0	267 13 0
		Gluta ..	380					
		Palaquium ..	254					
1923–24 ..	67 11 0	*Gluta*	652	....		167 7 6	105 6 0	340 8 6
1924–25 ..	..	*Hopea*	18	....		84 12 0	7 8 0	92 4 0
1925–26 ..	10 5 0	....	..	....		..	..	10 5 0
								1,434 15 9
2 *Kannikatty*—								
1922–23 .. (89 acres)	838 8 0	*Palaquium* ..	186	*Artocarpus hirsuta.*	1,250	..	199 15 6	1,038 7 6
		Balanocarpus ..	319					
		Chukrassia ..	6					
		Mesua	7					
		Eugenia ..	22					
1923–24 ..	129 15 0	*Gluta*	969	*Hopea* ..	..	..	109 11 0	239 10 0
		Pygeum ..	16					
1924–25 ..	..	....	..	....		96 0 0	..	96 0 0
								1,374 1 6
3 *Kannikatty*—								
1923–24 .. (53 acres.)	531 13 6	*Gluta*	758	....		..	164 8 0	696 5 6
		Pygeum ..	68	....		..	..	..
1924–25 ..	88 12 0	*Mesua*	25	....		..	7 8 0	96 4 0
								792 9 6

Locality. (1)	Cost of felling C. class species. (2)	Dibbling and sowing number of measures of seeds. (3)		Planting (seedlings). (4)		Weeding. (5)	Cost columns (3), (4) and (5). (6)	Total cost. (7)
							RS. A. P.	RS. A. P.
4 *Kodamadi*—								
1921–22 .. (97 acres).	557 6 6	*Dysoxylom* ..	12	*Hopea* ..	6,644	..	168 4 0	725 10 6
		Balanocarpus ..	670	*Gluta* ..	1,544			
		Hardwickia ..	205	*Balanocarpus* ..	300			
		Cedrela ..	14					
		Pygeum ..	114					
		Vitex ..	5					
		Aglaia ..	1					
1922–23 ..	442 8 0	*Hardwickia* ..	167	....		..	174 0 0	616 8 0
		Vitex ..	42					
		Mesua ..	120					
		Filicium ..	24					
		Gluta ..	347					
		Artocarpus ..	30					
		Chukrassia ..	10					
		Balanocarpus ..	162					
		Pygeum ..	8					
1923–24 ..	145 10 0	*Gluta* ..	583	*Hopea* ..	20,240	..	144 9 0	290 3 0
		Pygeum ..	106	*Balanocarpus* ..	4,075			
		Hardwickia ..	30					
		Filicium ..	2					
								1,632 5 6
5 *Kodamadi*—								
1922–23 .. (103 acres)	950 9 0	*Hardwickia* ..	243	....		..	215 6 0	1,165 15 0
		Balanocarpus ..	1,042					
		Mesua ..	136					
		Gluta ..	43					
		Pygeum ..	8					
		Palaquium ..	495					
1923–24 ..	128 12 0	*Balanocarpus* ..	100	....		..	47 0 0	175 12 0
1924–25 ..	..	*Dalbergia* ..	745	....		..	47 0 0	47 0 0
		Artocarpus ..	14					
		Terminalia tomentosa.	8					
								1,388 11 0
6 *Kodamadi*—								
1923-24 .. (51 acres)	522 7 0	*Gluta* ..	1,147	*Hopea* .. (1 year old)	16,400	..	294 0 0	816 7 0
		Cedrela ..	1	*Balanocarpus* .	500			
		Chukrassia ..	12					
		Filicium ..	7					
		Dalbergia ..	7					
		Balanocarpus ..	30					
		Pygeum ..	72					
		Hardwickia ..	17					
		Mesua ..	50					
1924–25 ..	..	*Dalbergia* ..	765	....		..	67 12 0	67 12 0
		Artocarpus ..	7					
		Hopea ..	417					
		Terminalia ..	7					
								884 3 0

The results from year to year were pronounced most unsatisfactory. It is probable that with the limited knowledge of the sylviculture of the various species, the light conditions which favoured the growth of a particular species were detrimental to the growth of others. The mistake made was to attempt to grow too many species under the same conditions. Large quantities of seed were destroyed by rodents and insects, and the little germination which occurred was destroyed by drought among other causes. The expense of these operations was also a serious drawback. Excluding overheads and interest charges which together would amount to a considerable amount, the following table shows the total expenditure incurred :—

Locality.	Area in acres.	Total expenditure.	Expenditure per acre.
	ACS.	RS. A. P.	RS. A. P.
1 Kannikatty— (1921–22)	81	1,435 0 0	17 11 0
2 Kannikatty— (1922–23)	89	1,374 0 0	15 7 0
3 Kannikatty— (1923–24)	53	793 0 0	15 0 0
4 Kodamadi— (1921–22)	97	1,674 0 0	17 4 0
5 Kodamadi— (1922–23)	103	1,389 0 0	13 8 0
6 Kodamadi (1923–24)	51	884 0 0	17 5 0

Again some of the important species such as *Hardwickia pinnata*, *Vitex altissima*, and *Cinnamomum* sp., and *Aglaia roxburghiana* were classed as B class together with inferior species like *Cullenia excelsa*, *Carnarium strictum* were consequently girdled or cut to favour A class species. The cutting or girdling of B and C class species up to 18 inches girth and the subsequent girdling of some B and C class species of 18 inches to 24 inches girth, opened out the canopy too much with the result that masses of inferior species, such as *Cinnamomum*, came in and swamped the regeneration of the better species. Finally the operations had to be done with labour recruited from the plains and it is highly probable that these coolies, owing to their ignorance of shola species, destroyed unwittingly a large quantity of the regeneration of the more valuable species in tending operations.

196. *The new policy.*—In 1927 therefore the hope of securing advance regeneration was definitely abandoned, and the new policy of removing the exploitable trees first and regenerating the gaps subsequently was inaugurated. Mr. Kesava Vittal was posted on special duty for the purpose. His work may be discussed under the following heads :—

(*a*) Nursery practice.

(*b*) Artificial regeneration.

(*c*) Natural regeneration.

(*a*) Nursery practice.

The following tentative conclusions regarding evergreen nursery practice were arrived at from the work of the special officer :—

(1) Fencing of the nursery was found to be essential in order to prevent the destruction of the seed and germinating seedlings by mousedeer, porcupine, squirrels, rats and vermin. A fence 4½ feet high made of split reeds tied together almost touching each other was found quite effective and cost about Rs. 1–8–0 per chain.

(2) Care taken in the collection of good seed and dibbling it *as soon as possible* after collection was amply repaid by a high germination per cent.

(3) The depth of sowing should not exceed the thickness of the seed. A thin covering of leaf mould especially over small or light seeds was found to be advantageous.

(4) Watering during germination and periods of drought was necessary and was best done with a watering can having a fine spray.

(5) Seedlings from the open nursery, i.e., not under natural shade, stood transplanting better than those from the shola nursery, although the latter appeared to look more healthy.

(6) In the open nursery it was found advantageous, in order to prevent wilting of the seedlings, to shade the beds with reed screens, during the hottest part of the day.

(*b*) Artificial regeneration.

197. When a tree is felled a lot of damage is inevitably done to the surrounding forest, and a gap of varying dimensions, according to the height of the tree and the size of its crown is caused. The sawyer cuts out *all* saplings in the immediate vicinity of the tree trunk in order to erect the requisite scaffolding for sawing. The resulting leaf and small branch wood debris is generally burnt, as its retention is found to attract a species of gadfly which is a source of annoyance. Thus hardly any regeneration is left in the gaps undestroyed. After the rains some of the cut back saplings and seedlings send up side shoots which are more of the nature of pollard than coppice shoots. The gaps thus caused vary in extent from ¼ square chain to 1 square chain. Artificial regeneration is of two kinds, dibbling and transplanting of seedlings from the nursery :—

(1) *Dibbling.*—The general conclusion arrived at was that the expense was not justified by the results obtained. Seeds of *Mesua*, *Balanocarpus*, *Eugenia* and *Dysoxylum* were readily attacked by vermin or insects and destroyed. Seeds of *Aglaia*, *Pœciloneuron*, *Chukrassia* and *Hopea* were available only at a time which did not synchronize with suitable rainfall conditions for dibbling. Other species like *Vitex* and *Cedrela* with very small seed having a low germinative capacity were better raised in a nursery prior to transplanting in the forest. *Heritiera papilio*, *Gluta* and *Acrocarpus* were the only species which could be successfully dibbled.

(2) *Transplanting.*—The south-west monsoon generally bursts in the first week of June, and after a short break, it comes on again. It is during this second onset

of the monsoon that the best results from transplanting were obtained. The following table shows at a glance the information collected on the subject of planting :—

Species.	Transplanting. Optimum age.	Optimum height.	
		INCHES.	
Mesua ferrea	1 year.	4	Three to four months old seedlings give fair results.
Chukrassia tabularis	6 months.	6	
Balanocarpus utilis	3 „	..	
Cedrela toona	6 „	..	One year old stump plants were successfully planted out.
Dysoxylum malabaricum	9 „	8	
Hardwickia pinnata	6 „	..	
Acrocarpus fraxinifolius	6 „	6	One year old seedlings 1′—1½′ high were successfully stump planted.
Hopea parviflora	1 year	4	

Owing to the comparatively slow rate of growth of the evergreens in early youth tending by cutting out weeds and grass directly interfering with the seedlings was found essential for a period of two years. The following table shows the results of enumeration in November 1932 of selected gaps in the various coupes :—

Species.	Date of Dibbling.	Date of Planting.	Average percentage survivals.	Average height growth in inches in November 1932.
		COUPE I—KANNIKATTI.		
				INCHES.
1 *Acrocarpus* ..	June 1929 May 1930 ..	November 1929 ..	58	72
2 *Aglaia*	.... ..	Do. ..	50	9
3 *Gluta*	July 1929 ..	.... ..	40	15
4 *Chukrassia* ..	.... ..	November 1929 ..	70	24
5 *Cedrela*	June 1929 ..	Do. ..	38	24
6 *Mesua*	.... ..	Do. ..	40	15
7 *Vateria*	December 1928.	December 1928 ..	..	30
		COUPE II—KANNIKATTI.		
1 *Acrocarpus* ..	May 1930 ..	.... ..	61	60
2 *Mesua*	.... ..	June 1930	60	14
3 *Aglaia*	.... ..	Do.	61	6
4 *Hopea*	.... ..	November 1930 ..	50	6
5 *Chukrassia* ..	.... ..	October 1930 ..	75	42
6 *Balanocarpus* ..	December 1930.	.... ..	100	6

It was discovered by experiment that it was advantageous to plant *Acrocarpus*, *Chukrassia* and *Vitex* seedlings in the centre of the gap where they could receive most light, and *Mesua* and *Hopea* seedlings near the periphery of the gap where there was the maximum of shade. *Gluta* seedlings did well in the intermediate space. *Hopea* and *Balanocarpus* did not seem to thrive over an elevation of about 2,500 feet; the two species are usually found in nature flourishing at elevations between 1,000 feet and 2,000 feet. The following table gives details of actual costs of the gap regeneration undertaken :—

Coupe number.	Number of gaps.	Year of regeneration.	Cost of nursery.	Cost of seeds.	Planting.	Dibbling.	Weeding.
			RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
I	150	1928	10 0 0	..	..	1 8 0	..
		1929	3 0 0	9 12 0	15 12 0	21 10 0	..
		1930	..	..	..	..	4 6 0
II	105	1930	27 5 0	5 0 0	22 8 0	14 12 0	..
		1931	..	..	7 8 0	5 4 0	..
		1932	..	..	..	..	..

The total cost for 255 gaps thus amounted to Rs. 148–5–0 or As. 9–1 per gap excluding overhead and interest charges. It must be borne in mind however that much of the work of weeding was done free of cost by local subordinates. Allowing for working on a larger scale and for increased efficiency due to experience and better organization the following charges per gap appear reasonable :—

	RS. A. P.
First year—	
Nursery charges	0 2 6
Dibbling	0 2 0
Transplanting	0 3 0
Weeding	0 2 6

	RS.	A.	P.
Second year—			
Replacing casualties	0	2	0
Weeding	0	3	0
Third year—			
Weeding	0	4	0
Total ...	1	3	0

On the basis of an average of 2·5 gaps per acre, the expenditure per acre for the three-year period will be Rs. 2–15–6 or Rs. 3. Considering that a revenue of Rs. 16 per acre on the very conservative basis of Rs. 6 per tree is obtained from exploitation. An expenditure of Rs. 3 per acre on regeneration is not unjustified.

(*c*) Natural regeneration.

198. The desirability of tending existing natural regeneration over the whole annual coupe, by performing light cuttings, so as to free the more valuable species from suppression has exercised the minds of all Forest Officers who have had to deal with evergreen forests. That there is sufficiency of the more valuable regeneration present can be deduced from the following table which gives the result of chain wide strip enumerations carried out in the exploitable areas in the evergreen sholas of the division :—

Number of seedlings and saplings found.

	Kodamadi, 6·2 acres.				Kannikatty, 11·25 acres.				Kuduvarai, 10·40 acres.				Sengalteri, 13 acres.			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Acrocarpus fraxinifolius.	..	..	..	..	..	1	..	..	..	..	2	..	..	..	..	..
Aglaia roxburghiana ..	128	44	41	2	92	225	45	11	5	20	15	..	..	..	..	..
Artocarpus sp.	..	..	..	..	9	34	26	12	5	5	3	..	7	3	25	21
Bischofia javanica ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Cedrela toona ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4
Dysoxylum malabaricum.	..	2	2	..	..	..	1	..	..	..	..	..	..	..	..	..
Filicium decipiens ..	..	..	..	..	..	..	2	..	1	10	7	3	..	..	..	..
Gluta travancorica ..	190	98	32	7	2,112	450	298	45	33	24	19	4	..	..	..	..
Hardwickia pinnata ..	..	1	1	..	..	..	1	..	1	3	3	..	..	..	..	..
Heritiera papilio ..	..	9	7	3	..	36	34	3	18	170	103	11	..	..	4	3
Mangifera indica ..	..	..	2	1	2	..	2	..	17	152	29	4	891	235	108	14
Mesua ferrea	86	346	236	14	377	520	382	44	135	894	686	31	2	6	15	..
Palaquium elipticum ..	3,577	1,554	465	47	6,018	2,459	870	171	2,848	1,896	499	49	49	25	109	64
Pterospermum sp. ..	..	..	..	..	..	..	3	2	..	..	..	..	..	..	..	..
Total ..	3,981	2,054	786	74	8,619	3,726	1,677	290	3,063	3,174	1,366	102	949	269	261	107

NOTE—Column 1. Seedlings below 1 foot high.
2. Do. from 1 to 5½ feet high.
3. Saplings above 5½ feet high but below 6 inches in girth.
4. Do. Do. 6 to 12 inches in girth.

Past experience has shown however that it would be very injudicious to prescribe tending operations as—

(*a*) the most favourable light conditions for the growth of our evergreen species has not yet been accurately studied;

(*b*) the species themselves are difficult to identify in the youthful stage and hence there is a grave danger that ignorant coolies and subordinates might cut out just the seedlings and saplings which ought to be encouraged.

(*c*) the cost of such an operation would be great, and, in the absence of knowledge as to its utility, unjustified. An experimental tending over 1½ acres in Kannikatty was found to require three coolies at a cost of Rs. 2–4–0. (The coolies however were new to the work.) Such research as has been conducted in the past on this subject warrants the assumption that tending would be helpful in increasing height growth. Details are available in plot files 5, 6 and 7 in the District Forest Office, but are not given here as the measurements were not recorded on a strictly comparable basis. For the period of this working plan it is desirable therefore that tending of natural regeneration be restricted to an area, (say 25 acres), in the annual coupe, on which the work can be supervised by the District Forest Officer in person. With increasing knowledge of the identity and silvicultural requirements of the valuable evergreen species, the area of such tending may be extended if the results justify such a procedure.

C. Plantations.

199. *Plantations.*—The subject will be treated under (*a*) teak plantations and (*b*) exotics. The earliest teak plantation in the division was made about 1888 in two patches, one near the Athithondu rest-house and the other about half a mile away in the Valaikulam Fuel Series. There are no records to show how it was raised, but both the soil and the locality were so unsuitable for teak that it is surprising that the plantation was raised at all. The two areas have been included in the Valaikulam 'simple coppice' fuel series and are worked on a rotation of 30 years.

(a) Teak plantations.

200. *General.*—With a view to ascertaining the suitability of the semi-evergreen forests, for teak, Mr. Richmond raised a small plantation of 0·91 acres at Kariar in 1907. The success of this plantation which still remains the finest departmental plantation in the division, provoked succeeding District Forest Officers to plant this species on similar areas on a larger scale. The labour of Kanis, was enlisted in forming such plantations between 1912 and 1915 at Kariar under the " ponam " system, i.e., in conjunction with field crops. These plantations were a success. The 1912 plantation at Kariar in particular although small, being only 4·5 acres in extent is an unqualified success, and removes any doubt as to the possibility of making use of this system in the district. From 1917 onwards teak plantations were started in the Serviar valley near Kodamadi. There are some 260 acres of teak plantations in the Kariar and Serviar valleys.

201. *Method of formation.*—The earliest departmental plantations were made by transplanting seedlings from a nursery, early in north-east monsoon, i.e. October–November. In 1917 a departure from this procedure was effected, seedlings being transplanted in July during the South-west monsoon. Owing to the fact that nursery work was not well organized planting continued from July to November, the seedlings being transplanted as they became available into pits 1 foot cube, at an espacement of 6 feet by 6 feet. Casualties were naturally execssive being as high as 66 per cent in the 1917 plantation. In addition dibbling of teak was resorted to in order to reduce the replacement of casualties with nursery transplants. A combination of these two methods was adopted in all plantations raised up to 1925. In 1922 a small experiment in stump planting one year old teak stumps over an area of 3 acres in the current year's plantation, was carried out during the north-east monsoon. As was to be expected the growth did not compare favourably with the seedlings transplanted during the south-west monsoon.

202. *Stump planting.*—In the Kariar and Serviar valleys the south-west monsoon usually appears in late May or early June, and is preceded by three months of hot and dry weather during which the raising of seedlings in a nursery is a task which requires unremitting care and excessive watering and shading. This rules out the possibility of using seedlings for transplanting during the south-west monsoon. The north-east monsoon although more capricious, bursting as it does at any time between the last week of October and the first week of December, brings with it a greater *amount* of rainfall. Seedlings for transplanting during this monsoon can be raised without much difficulty during the preceeding south-west monsoon; the greatest objection to north-east monsoon planting however, is, that the seedlings have barely time to establish themselves before they are subjected to drought from February to early May. Casualties are therefore excessive. For these reasons, stump planting *as soon as* the south-west monsoon bursts or if the ground is soft enough, a few weeks earlier appears to be the most suitable method of planting. The reserve of food material in the stump enables it to tide over rainless periods of short duration, and the deeper planting enables the stump to tap moister levels of the soil. The success of the 1932 teak plantation at Kariar and Kodamadi may be attributed mainly to stump planting, although the work was not sufficiently organized to enable complete advantage to be taken of the rains of the south-west monsoon. It is essential for success and for reducing the costs of weeding and replacing casualties, to stump plant as soon as the ground is soft enough to receive the stump. Hence burning and staking operations should be completed by the middle of April at the latest. The actual planting should also be so organized that it is completed over the whole area in as short a time as possible. Failures in the past have largely been due to dilatory planting spread over many months.

203. *Condition of plantations.*—The neglected state of many of the older plantations of recent years has frequently been commented upon in inspection notes of the division. The boundaries between the various plantations are so overgrown as to be practically unrecognizable, thus increasing the difficulties of making thinnings. It seems to have been the custom to leave a plantation to itself once it had been successfully established. Much suppression by creeper growth and fast growing soft wood species such as, *Helicteres isora, Trema orientalis, Sterculia* sp., *Grewia* sp., *Pterospermum* sp., has occurred. The 1913 and 1914 Kani plantations contain huge *Terminalia arjuna* trees over 4 feet in girth which have already done immense damage to the teak. A regular scheme of thinnings and cleanings is therefore indicated.

204. *The Kuttalam plantations.*—In 1931 an area of about 10 acres in the Kuttalam Fuel Series near Five Falls was sold to a contractor and clear felled, and burnt by him. The area was handed over to a *ponamdar* for planting up with teak in conjunction with field crops, in May 1932. However the whole of the staking and planting was done by the local subordinates. The *ponamdar* insisted on growing gingelly, ragi, samai, chillies and some vegetables, and in return for these concessions did little beyond weeding

the plantation and that generally only when superior officers visited the place. Such conditions should not be allowed and if the land is to be given for ponam cultivation it must be on our terms, and they must be strictly adhered to. In view of the fact that the standing growth is sold for as much, in some cases, as Rs. 40 per acre, the saving effected by getting the planting and weeding done by ponamdars is not a matter of great consideration. If then their work is not satisfactory, the small plantations in this locality will have to be made departmentally.

The raising of small plantations not exceeding 10 acres in extent annually, on areas especially suitable for teak in the coupes of this felling series will be prescribed. Such plantations, after formation will be included in the Clear-felling Working Circle in order to control their future treatment.

(*b*) Exotics.

205. *Bamboos.*—The earliest attempt at introducing the bamboo, *Bambusa arundinacea*, was Haynes' Aladiyur bamboo plantation, raised about 1884 at a cost of Rs. 290. In 1902 Rs. 230 was realized by the sale of 1,000 bamboos from this area, and 1,000 bamboos have been extracted annually ever since. The success of the Aladiyur plantation gave a great impetus to the planting of this bamboo in the division and between 1903 and 1912, it was introduced in the following areas.

Year and locality.

Nanguneri range—
1903 Valliyur Reserve: along the Valliyur irrigation channel.
Kombai Ar: along the banks.

Ambasamudram range—
1903 Idaimuttikidai—Koilteri Fuel Series.
1884 Aladiyur—along the Tambaraparni.
1886 Kariar—along the Kariar.
1903 Sivaisalem—along the Karunai Ar.

Kuttalam range—
1903 Puckles path—Kuttalam Fuel Series.
Vallam—Kuttalam Fuel Series.
Thalayani—Vasudevanallur Fuel Series.

Srivilliputtur range—
1903 Alagarcoil vally—along the Athithondu Ar.

206. *Bamboo prices.*—The opening of the Shencottah–Trivandrum Railway line resulted in a distinct set back to bamboo prices, owing to the competition with bamboos from Travancore State. In 1903–1905 the price for standing bamboos was between Rs. 15 and Rs. 19 per 100 at Aladiyur and Kariar, respectively. The prices now as will be noticed from the table below, vary beween Rs. 3 and Rs. 6 per hundred :--

Locaiity.	Price per 1,000 bamboos.				
	1927.	1928.	1929.	1930.	1931.
Nanguneri range—					
Valliyur reserve	53	91	80	51	94
Ambasamudram range—					
Kariar	70	33	45	31	33
Idaimuttikidai	66	45	35	35	47
Kadayam	62	30	32	61	20*
Sivaisalem	...	26	34	28	28
Aladiyur	...	...	...	...	26
Kuttalam range—					
Kuttalam reserve	50	61	60	410*	35
Thalayani	...	26*	40	*40	35
Panpuli					

* Denotes all dead bamboos quantity unspecified.

207. *Method of formation.*—The plantations seem to have been raised by three methods :—

(1) Planting out one-month old nursery seedlings.

(2) Planting out offsets.

(3) Planting out rhizome cuttings.

Of these three methods planting out seedlings was definitely the most successful, and planting out rhizome cuttings was found to be least successful. Latterly experience in other districts has shown that the best results are obtained by planting out one or two year old rhizomes grown in a nursery till about the size of the top joint of a man's thumb.

208. *Extraction.*—The green bamboos to be extracted (1,000 annually from each locality) were marked departmentally and sold standing to contractors. Owing to the marking having usually been restricted to the perihery of the clump,—for what reason is not apparant,— very grave congestion of the clumps has resulted. A heavier marking was accordingly ordered in 1932 and this erred in being too heavy especially at Kariar,

where only one-year old culms were retained in many clumps. It is desirable now to divide each bamboo area into three annual coupes, and work it on a three-year rotation, permitting the contractor to do his own felling, subject to the conditions that—

(*a*) all one-year old culms are retained;

(*b*) at least eight older culms are left in each clump for its mechanical support and to provide nutrition for the rhizomes; and

(*c*) no culms are felled higher than 3 feet from the ground. Prescriptions will be framed accordingly.

209. *Mahogany.*—Between 1887 and 1889, 3 acres were planted with mahogany (*Swietenia mahogani* and *Swietenia macrophylla*) in the Kalivayur reserve, now handed over to the Public Works Department, and in the Mundanthorai and Kuttalam bungalow compounds. The results were so gratifying that these species were introduced in subsequent years in other areas. In 1903, 141 seedlings were basketed and planted as follows :—

(*a*) Twenty-eight in Sivanaperi bungalow compound.

(*b*) Thirty-eight at Sengalteri.

(*c*) Seventy-five in Valliyur reserve.

The seedlings at (*a*) and (*c*) had to be watered throughout the hot weather; those at (*b*) failed completely, the elevation of 3,500 feet probably being too high. Mr. Richmond was of opinion that a sandy soil was apparently best suited to the species while a clayey loam such as that found at Kuttalam was excellent. In 1906 further planting work was done at Kariar, in the Padaramalai Fuel Series and in the Kuttalam Felling Seris, old coupe XIII; but the operations in the Pandaramalai Fuel Series were a total failure, while those in the Kuttalam Fuel Series and at Kariar were only partially successful. Watering in the dry weather was found to be necessary. In the early stages, the leading shoot of mahogany was attacked almost invariably by a shoot borer, which induced the production of multiple shoots. This damage is particularly apparent in the Valliyur reserve where almost all the mahogany is badly grown owing to this defect. At Kariar the mahogany, *Swietenia macrophylla*, is exhibiting signs of stag headedness probably owing to unfavourable soil conditions. The growth of *Swietenia mahogani* at Mundanthorai justifies the extension of plantations of this species on an experimental scale in suitable localities especially as specimens of the timber grown in India have recently been very favourably reported upon by the Research Institute at Princes Risboro, and by experienced cabinetmakers who were given some to try.

210. *Casuarina.*—Casuarina was introduced in 1905 in the Valliyur reserve of Nanguneri range. The plantation (about 6½ acres) was raised at great cost as it had to be watered, according to local information for six years and for nearly six months every year. It died naturally in 1930 and was sold for Rs. 1,500 as fuel, the average yield of fuel per acre being 12 tons. The difficulty of raising it, and its slow growth does not justify future planting of this species.

211. *Cassia siamea.*—*Cassia siamea* was introduced in two-acre plots in 1930 in Padmaneri and Terku Viravanallur Fuel Series, respectively. In the latter fuel series two pounds of seed were sown half on prepared mounds and half in pits one foot cube in late October 1930. Ninety per cent germination was observed in both in January 1931, but an enumeration carried out at the end of March 1931 showed 442 survivals among the mound plants and, only 18 survivals among the pit plants. Mound planting was apparently the more successful. In 1932 the seedlings were 5–6 feet high and looking very healthy, forming a refreshing contrast to the rest of the coupe which is covered with thorny scrub jungle. In the Padmaneri Fuel Series, old coupe X, a similar experiment was carried out but enumerations in March 1931 showed 401 survivals among the mound-planted seedlings and 796 seedlings in the pit-planted seedlings, an opposite result to that obtained in the previous instance. In 1932, 400 survivals were enumerated the height being from 4–6 feet. Both experiments were conducted free of cost by the local beat subordinates.

A similar experiment carried out in old coupe X of Manpothai Fuel Series in 1930 was a total failure. Germination was as high as 50 per cent but all the seedlings died of drought, as there was no rain for about two months after germination. *Prosopsis juliflora* was also introduced simultaneously and although the germination was reported to be as high as 90 per cent the seedlings died out from the same cause. The results show that these species can be raised and if conditions of rainfall are suitable and they survive, will be invaluable for increasing the stocking in our drier fuel forests. As the leaves of *Cassia siamea* are not eaten by cattle, its introduction is specially advantageous. The possibility of introducing other exotics such as *Acacia auriculiformis*, which has been successfully grown in dry forests of Nellore division, merits consideration.

D Afforestation.

212. *The Kudiraimozhi Teri Reserve.*—This reserve (hereinafter alluded to as the Teri), has been referred to in paragraph 15 above. From as early as 1848 attempts were made to fix the great masses of shifting sand in the reserves, with the object of saving the cultivated lands on the eastern edge from being destroyed by the sand blown over by the furious winds which rage in the area from June to October. At first these efforts consisted in encouraging ryots to take blocks of land on *cowle* tenure, and to plant up the area gradually with tree growth, principally the palmyra, in conjunction with field crops where possible. The response in the early years was gratifying and besides palmyra, seeds of *Acacia planifrons*, *Dalbergia multiflora* and *Dodonea viscosa* were sown with ragi and other cereals, but the disappointing results discouraged further private enterprise in this direction. Later the success of the system of penning goats fed on pods of *Acacia planifrons*, in afforesting the sandy areas on the coast, led to its adoption in the Teri but the results, owing presumably to the deeper water-level and the shifting sand, were again disappointing. Private enterprise having so signally failed, it was considered necessary to reclaim the area through Government agency, and some 13,400 acres was reserved (vide G.O. No. 636, dated 21st June 1892).

213. *The Palmyra.*—The palmyra has been used extensively in the afforestation of the Teri. The work done in this direction from 1876 to 1892 was abstracted by Mr. Thornton in 1893 and is of such great interest that his report is given in full in Appendix V to this plan. A Working Plan for the Teri was prepared by Mr. P. M. Lushington (vide Board's Proceedings, Land Revenue Forest, No. 250, dated 13th July 1901). Under it the reserve was divided into the following five circles :—

	ACS.
Semmarikulam	2,750
Nazareth	1,050
Kachinavilai	1,803
O'neill	1,003
Teri	6,360
Total ...	12,966

The works to be undertaken were—

I. *Semmarikulam Series.*—Nine compartments—
(1) Sale and removal of dead palmyras,
(2) enumeration, classification and leasing of classified palmyras,
(3) trenching and trimming of *vadalis* and *olaivettus*,
(4) filling up blanks in the palmyra plantations and underplanting with *Dalbergia multiflora* and *Acacia planifrons*.

II. *Nazareth Series.*—Five compartments. In addition to the works prescribed under series I the planting of palmyras on 170 acres annually was prescribed.

III. *Kachinavilai Series.*—Six compartments. The same work was prescribed as in series I.

IV. *O'neill Series.*—Ten compartments. To be planted with palmyras at the rate of 100 acres per annum.

V. *Teri Series.*—The only work to be undertaken was the planting of Banyan (*Ficus bengalensis*) cuttings 30 feet apart, along either side of the three principal roads crossing the series. The length of the roads being 12 miles, the planting was to be undertaken over a mile per annum.

The prescriptions of this Working Plan were more or less followed up to 1911 when the period of the plan expired. The revenue was estimated to be Rs. 700 per annum and the expenditure proposed just covered it. The control records prescribed, however, were either not maintained or have been since destroyed. Between 1911 and 1917 in the expressive words of the control journal "nothing was done." The subsequent work done is tabulated below :—

Year.	Locality.	Work done.	Cost RS.	A.	P.	Results.
1918—						
	Series IV.	1,31,250 palmyra nuts dibbled.	254	3	8	98 seedlings alive on 24th December 1921.
	Series I. Compartment 7.	*Acacia planifrons* sown in pits over 15 acres.	5	4	0	
	Kayamoli.	Do. do.	7	2	6	
1926—						
	Series IV	12 acres dibbled with 5,220 palmyra nuts at an espacement of 10′×10′.	71	15	C	

Year.	Locality.	Work done.	Cost. RS. A. P.	Results.
1927—				
	Lushington Series ...	21,750 palmyra nuts dibbled over 50 acres.	69 12 0	......
	Kachinavilai Series ...	75 acres were dibbled with palmyra nuts.	106 15 0	......
	Kachinavilai Series. Compartment 2. Semmarikulam. Compartment 7.	Sowing of *Dalbergia multiflora.*	22 0 0	Total failure.
	Do. ...	Sowing of *Acacia planifrons* seeds.	50 0 0	Do.
	Teri Series	Dibbling palmyra nuts over 28 acres.	395 0 0	Much of this was lost on account of shifting sands.
1928—				
	Lushington Series. Compartments 4. O'niell extension Series. Compartments 4. Nazareth Series. Compartments 2, 3, 5.	Dibbling palmyra nuts over 289 acres.	650 4 0	......
1929—				
	Teri Series	Cashew sowing over 5 acres.	13 12 0	Only 17 survivals in 1931.
	Teri Series. Compartments 1–7.	Palmyra nuts dibbled over 1,100 acres.	2,571 3 0	60 per cent success.
	Teri Series	10 acres dibbled with seeds of *Acacia planifrons* collected from goat droppings.	47 0 0	Total failure.
	Do.	50 acres sown with *Dodonea viscosa.*	68 5 0	Do.
1930—				
	Teri Series. Compartments 8–13.	Palmyra nuts dibbled over 1,100 acres.	2,571 3 0	70 per cent success.
	Nazareth rest-house compound.	*Acacia planifrons* collected from goat dung were sown in a nursery and the seedlings planted in pits 6′ × 6′, and shaded with palmyra leaves stuck in the sand.	1 8 0	Survivals in March 1932, 615 seedlings 3″ to 1½′ high.
1931—				
	Teri Series. Compartments 14–16.	500 acres dibbled with palmyra.	875 12 0	70 per cent success.
	Teri Series. Compartments 1–4.	Compartment lines planted with Banyan cuttings.	36 0 0	......
1932—				
	Teri Series. Compartment 17. O'neill extension series compartments 5, 6 and 7.	500 acres planted with Banyan cuttings.	880 0	75 per cent success.

214. *Wind direction.*—A brief discussion of the merits and demerits of palmyra planting will not be out of place here. In the Teri reserve two distinct conditions are recognizable. The first, is the area of fixed or stationary sand dunes in Nadu Teri and Kalpallam, and the second, the area comprising most of Teri Series V where there are moving sand dunes or alternatively no sand dunes, but stretches of moving sand. The latter are the so called " sand supply areas " which feed the dunes by wind action. The prevailing wind direction during eight months of the year, i.e., from March to the middle of October, varies slightly between west, south-west to west, north-west or a few points north or south of west. During this season the winds are violent and the sand being dry is more apt to be shifted by them, than during the north-east monsoon when the winds are usually of less intensity and the sand more moist and heavy. It is only the west wind which therefore needs consideration. and afforestation should therefore logically start from the west and proceed towards the east.

215. *Advantages of palmyra dibbling.*—The principal advantages of large scale mechanically dibbling of palmyra nuts are :—

(1) The technique of dibbling has been so highly developed that little departmental supervision is necessary for successful planting.

(2) The cost is comparatively low, amounting to Rs. 1–4–0 per acre in 1933.

(3) The stocking of the reserve with palmyras, if successful, would ultimately provide the raw material for the expansion of various local industries such as " *pathnir* " boiling for jaggery manufacture, basket making from the leaves, fibre making from the leaf sheath or " *pathel*," and toddy from the budding inflorescence. The timber from the palmyra would also find a ready market.

216. *Disadvantages.*—As against these advantages, the following drawbacks may be advanced :—

(1) The palmyra is very slow growing in early youth in these parts, reaching a height of 3 feet after ten years and this only in the more favourable localities. Hence, dibbled at an espacement of 10′ × 10′, such plantations will not serve as efficient wind breaks even if full stocking is assured, until the trees are 10–15 years old.

(2) Pure plantations of this species under the unfavourable rainfall and soil conditions prevalent on the Teri, are particularly liable to disease from insect or fungus attack. In fact the borer *Oryctes rhinoceros* has already appeared on the Teri and killed a number of palmyras. If the attack becomes epidemic, we run the serious risk of losing all our palmyras.

(3) Palmyra plantations on sand supply areas, such as practically the whole of Teri Series V, are very likely to be submerged by moving sand dunes. The process can be seen in progress in the 1932 plantations, while further east whole trees of *Odina wodier*, palmyra and cashew, 40 feet in height and more have been buried in the sand, only their tops appearing above it.

217. *Reclamation agents.*—The principal qualities of a sand reclamation agents are :—

(*a*) It should be capable of propagating itself rapidly without assistance.

(*b*) It should provide fairly dense and fairly low cover.

Judged by either or both of these standards the palmyra will be found wanting. An examination of reclaimed areas on the Teri will demonstrate that certain creeping grasses (*Spinifex sp.*), *Dodonea viscosa* and *Borreria hispida* are the most important agents. The encouragement of these species by artificial means, should really *precede* palmyra planting in order to ensure that the latter are not subsequently obliterated by shifting sand.

218. *Conclusions.*—On a consideration of the pros and cons, therefore, it appears to be desirable to reduce considerably the annual area to be planted with palmyra more particularly as the area remaining to be planted in the Teri Series and O'neill extension series is the worst yet tackled, being a mass of shifting sand. It would be more advisable to concentrate our energies on devising some comparatively inexpensive but efficient method of afforesting the western part of the Teri and when this has been done, afforestation can proceed eastward. The following measures merit consideration and will be prescribed on an experimental scale :—

(*a*) The prickly-pear *Opuntia dilenii* is likely to prove a very efficient wind break as it is comparatively easily raised, spreads rapidly without assistance and provides a valuable protection against illicit grazing. It is also a good nurse for the introduction of tree species like *Acacia planifrons*. Moreover it can be easily eradicated with the aid of the Cochineal insect, when it has fulfilled its purpose, or if it threatens to become a nuisance. In this connexion it seems to have been particularly unfortunate that small patches of the pear in the Semmarikulam series were infected with the Cochineal insect under the orders of the District Forest Officer in 1930 and destroyed. The idea was to burn the dead pear and sow seeds of *Melia azadirachta* in the resulting ash. The sowing was not a success. It is of such great importance to maintain the ground covering in these areas, that the destruction of any existing growth should not be undertaken unless its regeneration is certain. The most important work is to preserve the large palmyra plantations made in recent years in Teri Series V from gradual obliteration.

(*b*) The Cashew (*Anacardium occidentale*) besides providing a very appreciable annual revenue once it starts bearing, is one of ideal trees from the standpoint of reclamation as it has a huge low spreading crown and is not browsed by cattle. Unfortunately it is difficult to raise without watering in the early stages. The northern edge of Kachinavilai series (a reclaimed area) adjacent to the Kadamba tank seems to be the ideal place of introducing it, as watering will not present any difficulties owing to the proximity of the tank and its channels. Experimental plantations here with the ultimate idea of increasing the area planted, if the results justify such a step, will be prescribed.

(*c*) It is also desirable that the main rights of way across the Teri reserve be distinguished on the ground by avenues. At present it is almost impossible to know where one is, once one has walked into the Teri beyond sight of the Forest bungalow at Nazareth. The old working plan prescribed the annual planting of a mile of road with banyan cuttings. This salutary prescription has been responsible for such little shade as now exists on the Teri roads. The banyan is the ideal tree for this area as it can be raised from cuttings and extends naturally by aerial roots and attracts birds, which are valuable for spreading seed. *Odina wodier* too can be raised from cuttings. A regular scheme of avenue planting is therefore desirable.

219. *Palmyra leases.*—The present system of leasing out the usufruct of palmyras for a term of five years on an annual rental is not conducive to the securing of maximum revenue as if the quinqennial sales occur at a period of general depression in the prices of palmyra produce, the bids will be proportionately low. However, the system was introduced in the past as it was feared that annual leases would result in the lessee overworking the palmyras in order to secure the maximum revenue during the period of his contract. The need for preventing the gradual destruction of palmyras from this cause on these sparsely covered areas, is more important than revenue considerations and it therefore seems advisable to adopt a middle course by reducing the lease period to three years. A stricter application of the existing rules to prevent overcutting of leaves is desirable; the control exercised in the past on this important point has been of a perfunctory character. The right to collect minor forest produce (cashew nut and screwpine flowers) will be continued.

220. *Disreservation.*—In 1922, Mr. E. Perianayagam, M.L.C., moved the Collector for the disreservation of a portion of the Teri, with a view to provide the neighbouring villages with enlarged grazing grounds and land for cultivation purposes. An aggregate area of 1,952 acres of reclaimed land in the Nazareth and Semmarikulam series was accordingly selected and handed over to the Revenue Department for assignment in January 1925 in accordance with G.O. No. 2157, Development, dated 19th September 1924. In November 1924 further proposals for disreservation were made but were fortunately not entertained as the land previously disreserved had not yet been assigned. No assignment of the 1,952 acres has been made up to date, and the area, being open to unrestricted grazing and cutting of palmyra leaves is likely to revert in time to its original unreclaimed state, thus proving a menace to our efforts at reclamation of the Nazareth series on the leeward side of the disreserved area. As a grazing area the strip disreserved is of hardly any value. The fact that it has not been assigned for eight years shows that as cultivable land it is equally worthless. The Collector has attempted a solution of the problem recently by ordering the constitution of a panchayat for the area, but in view of the amounts we have expended on the reclamation of the area in the past, and considering its position on the windward side of the present reserve, much better protection would be afforded by reservation. Proposals to this effect have been submitted by the District Forest Officer and the matter is under correspondence.

At the same time an adjacent block of 208 acres, to the east of the main reserve which formed the Kayamoli reserve was also disreserved. In this area the following regeneration operations were done as late as 1918 :—

Year.	Locality.	Operation.	Result in 1920.
1918	Kayamoli	1. Sowing *Acacia planifrons* in furrows.	341 seedlings 6″ high.
1918	Do.	2. Sowing *Acacia planifrons* in 1,210 pits.	50 seedlings 6″ to 1′.
1919	Do.	3. Sowing *Acacia planifrons* in 158,400 pits.	1,829 seedlings 1′ to 2′ high.

All this regeneration seems to have been light-heartedly abandoned together with the reserve.

221. *The policy of disreservation.*—The folly of such disreservations can be realized from the fact that past experience has invariably shown that when such sandy wastes get to the stage when they are incapable of growing a crop of *Acacia planifrons*, or an occasional crop of horsegram or other cereal, there is an invariable tendency on the part of the pattadar to abandon the land. In 1910 a *cowle* was granted to Mr. M. S. Vairavanatha Pillai for an area of 2,446 acres adjoining Naduvakurichi and Arasur villages in Tiruchendur taluk, for a period of twenty-five years rent free. Nothing beyond the raising of a few field crops over a small portion of the area, and some desultory attempts at planting with palmyra nuts was done, and the cowle was revoked in 1915.

222. *Grazing.*—As early as 1894 grazing was permitted in portions of Semmarikulam and Nazareth series. Mr. Bryant who saw the damage done, excluded grazing entirely from the Teri from 1895 to 1898. Subsequently he reopened the Semmarikulam series, but as permits were taken for only five buffaloes and 69 cows, the compartment was reclosed. In 1899, Mr. Jackson, on the recommendation of the Ranger, opened Semmarikulam and a portion of Kachinavilai Series, but on inspection he found that grazing would be most inadvisable and closure was again resorted to. Mr. P. M. Lushington's plan in 1901 definitely prescribed closure of the whole reserve to grazing. In December 1914, on account of heavy floods in the Srivaikuntam taluk and the consequent submersion of village pasture lands, the whole of the Teri was thrown open to free grazing, under the personal orders of the Forest Commissioner. The concession was withdrawn in April 1915 as its continuance was not found essential, the requirements of reclamation being held to be superior to the claims to grazing advanced by the surrounding ryots. In spite of this, again from 1st July 1924, a belt of land half a mile wide along the boundary of the Teri

was thrown open to free grazing. Mr. Barry strongly protested against this, on the ground that past experience had fully proved the inadvisability of permitting grazing even on payment, and that free grazing would inevitably result in the destruction of the work of the past forty years. In the absence of demarcated boundaries showing the limits of the half mile belt, it was impossible for the subordinates to say whether cattle were trespassing, so that even if cattle were impounded the case would inevitably have been thrown out in court for lack of sufficient evidence on this point. Protection in the circumstances was farcical. This protest, however, was not effective as the Chief Conservator ordered that the grazing on the half-mile belt was permitted " with the knowledge and approval of Government " and the decision could not be revoked. In 1926, the Chief Conservator reported to Government that as reclamation work on a large scale was proposed to be carried out, the privilege of free grazing in the half-mile belt should be withdrawn. Accordingly in G.O. Ms. No. 820, Development, dated 4th June 1927, all grazing in the Teri was prohibited. This is the present position.

223. *Semi wild cattle.*—The problem of semi wild cattle alluded to in paragraph 64 above remains still to be solved. There are a number of these cattle (200 to 400 according to various estimates) which roam over the Teri and are for all practical purposes ownerless. As early as 1918, the need for the destruction or removal of these animals was felt and in G.O. Ms. No. 685, Revenue, dated 18th February 1918, it was ordered that semi wild cattle found in the Teri would be presumed to be ownerless and either caught or destroyed. Shikaries were paid Re. 1 for every animal-shot and were also given the option of purchasing the animal destroyed for Rs. 3; cattle which could be caught were to be impounded and not shot. About a dozen animals were destroyed in this manner according to the records but since the shikaries were intimidated by the local population, who professed to own the cattle the concession had to be withdrawn for lack of volunteers to shoot the animals. In 1928, three months warning in the District Gazette was given to all owners to remove their cattle from the reserve, and at the end of this period the right to capture the remaining cattle was put up to auction. The lessee was to receive three-fourths of the sale proceeds of all the captured animals and was to provide his own equipment, ropes, etc., for the operations. The idea was to drive the cattle into ambushed nets and thereby entangle and capture them. No information is available as to the results of this operation, but local enquiries show that the attempts were unsuccessful as the nets could not be staked to the ground sufficiently, strongly to hold the captured animals. If we are going to continue spending thousands of rupees on planting this area up with palmyra and other useful species, with the purpose of preventing the shifting sand from ultimately overwhelming acres of wet cultivation which lie to the east of the reserve, it is obvious that to allow some two or three hundred cattle to prejudice our chances of success would be the height of folly. It must be realized that there is little, if any, grazing in the area apart from our nice succulent young one or two year old palmyra plants, and the semi wild cattle no doubt appreciate the expensive efforts we make to cater for them. The damage done to the surface soil of the reserve by trampling and converting it to loose sand which is easily blown about, also greatly hinders its fixation. Our attempts at getting rid of the cattle in the past have been neither persistent nor organized. Unless the ryot is sure that we mean business, it is useless to expect him either to remove his cattle or assist us in their removal. The fact that from time to time calves are captured and taken to the village, with the object of attracting their mothers to come and feed them and incidentally be milked by the owner, is well known. Young bulls are also frequently captured, tamed and sold, with or without the knowledge and connivance of the local subordinates. It is quite clear, therefore, that the owners of these semi wild cattle treat the reserve as a private grazing ground to their own profit and to the detriment of regeneration operations. Capturing operations *departmentally* in the adjacent Vallanad reserve have proved a failure financially (vide paragraph 64). Since the whole of the Teri is closed to grazing no grievance can arise, if the cattle in it are destroyed. Three months notice in the District Gazette reinforced by wide publication in all the surrounding villages, to the effect that all cattle not claimed and *removed* would be treated as ownerless and destroyed should meet the case. Special beats for the purpose can be organized by the District Forest Officer and the Range Officer and the cattle destroyed, after due notice. In order to safeguard the large palmyra plantations over 3,000 acres made in the Teri Series, it is essential that this problem be tackled as soon as possible and the reserve be rid of this pest.

E. Fire protection.

224. *General.*—Dr. Brandis first pointed out the destructive effect of fires in the ghat forests of the division and suggested that if the object of management was to make the streams flow more evenly and to increase the dry weather supply in rivers, fire protection was the main point to be aimed at. The ghat forests at the time had suffered more from

annual fires than from excessive felling. The task of protection, however, was realized to be one of unusual difficulty owing to the rugged nature of the country. His proposals were briefly :—

(*a*) to secure the assistance of the persons who graze cattle in the forest. This was to be done by restricting free grazing to areas outside fire protected blocks. Within the latter the grazing was to be leased to a responsible person with whom an agreement was to be made, in which it was to be stipulated that on the occurrence of fires, the block would be closed forthwith, but if the contractor assisted in fire protection, the contract would be continued to him ;

(*b*) to regulate the shifting cultivation practised by the kanis ;

(*c*) to clear and burn fire lines, bearing in mind the facts that fire lines are useless in a hilly country unless a practicable path is opened out along side, and that tracts stocked with grass are always a source of danger and should be burnt early in the season. All paths were to be fire traced.

The present Nanguneri and Ambasamudram Ranges including the Kuttalam reserve were divided into six beats each under a forest guard. Fire watchers were proposed to be employed in the fire season each man being responsible for a certain length of fire line or path leading through the forest. The annual cost of fire protection for the first five years was expected to be Rs. 10,000.

225. *Early methods.*—In 1884 the first regular attempt at fire protection of a block of 40 square miles between the Serviar and the Kariar was attempted. The following was the expenditure in the various ranges up to 1895–96 :—

Name of Range.	Date operations started.	Area specially protected.	Expenditure. RS.	Average per annum.
Srivilliputtur	1888–89	11,000	3,485	498
Kuttalam	1888–89	37,000	8,000	1,143
Ambasamudram	1884–85	25,000	14,718	1,338
Nanguneri	1884–85	21,000	7,496	681

In 1896 Mr. Hooper said : " It is evident that the cost of protection is amassing a heap of debt against the forest and the irregular and unsatisfactory returns of protected area each season point to the doubtful success of the operation. It is for urgent consideration whether to extend rigid fire protection to any area under simple closure except it be under regeneration. It will be found that with a concentration of our efforts and funds on areas felled in the preceding five years we shall be quite as successful as in the past if we limit our work in the remaining ghat forest not yet under systematic working to the putting out of fires that may occur." He therefore limited expenditure on fire protection to the following amounts per annum :—

Range.	Amount.
Srivilliputtur	300
Kuttalam	500
Ambasamudram	500
Nanguneri	600

226. *Results.*—That this step was justified is clear from the inspection note of 1898 which said : " I consider the District Forest Officer has acted wisely in discontinuing to clear the length of fire lines cleared annually in former years, and relied more on the rule which has for a long time been in force in Tinnevelly of not permitting grazing for some years after a portion of the reserve has been wilfully burnt. The organized system prevailing in Tinnevelly of beating out fires the moment they occur is also partly responsible." In 1898 the total expenditure on fire protection was further limited to Rs. 1,000 a year. In 1901, however, it was felt that the increased working prescribed by the working plans just sanctioned, justified a greater expenditure on fire protection of the various working circles.

The average annual expenditure on fire protection for the period 1901–02 to 1912–13 was Rs. 2,293.

227. *Later modifications.*—In 1913–14 as a result of Mr. Peake's representations an ambitious programme for fire protecting the whole of the fuel series and the hill grazing compartments by a system of external and internal fire lines was sanctioned. All the common zamin and State forest boundaries not passing through shola forest were also fire-traced annually. The average annual expenditure on maintaining the fire lines and in paying fire patrols for the period 1913–14 to 1921–22 both years inclusive, amounted to the large sum of Rs. 4,781.

228. *Results.*—The following table shows the results of fire protection during the above period. The area under general protection was 206,712 acres while that under special protection was 35,688 acres :—

Year.	Fires in specially protected area. ACRES.	Percentage of area burnt.	Fires in generally protected area. ACRES.	Percentage of area burnt.	Total cost of operations. RS.
1913	4,080	11·4	4,633	2·3	5,042
1914	5,111	14·3	2,320	1·1	5,444
1915	12,277	3·6	5,733	2·8	5,100
1916	2,392	6·7	5,285	2·5	4,764
1917	3	—	4,817	2·3	4,935
1918	74	0·2	12,899	6·2	4,527
1919	1,709	4·8	2,545	1·2	4,900
1920	3,052	8·5	2,779	1·3	4,419
1921	1,917	5·3	9,534	4·1	5,132
1922	2,866	8·0	6,503	3·1	2,842

229. *Recent methods.*—The need for greater economy in expenditure was realized in 1922. Many of the expensive interior fire lines were definitely abandoned and the old system of employing fire patrols during the fire season and fire-tracing only frontier boundaries where necessary, resuscitated. Although the administration reports for the period 1922–23 to 1932–33 make a distinction between areas specially protected and areas generally protected, in actual practice only general protection alluded to above is now undertaken over the whole of the ghat forests. The following table shows the results of general protection over an area of 242,937 acres :—

Year.	Area burnt in acres.	Percentage to area protected.	Total cost of operations. RS.
1923	15,538	6·4	1,557
1924	4,900	2·0	793
1925	16,485	6·8	856
1926	1,354	0·4	675
1927	2,939	1·2	574
1928	4,974	2·0	Nil
1929	5,783	2·3	343
1930	4,840	2·0	439
1931	12,107	4·9	388
1932	6,476	2·7	413

The percentage of area successfully protected compares very favourably with that obtained under the more expensive system in the previous period.

230. *Conclusion.*—From a detailed examination of the fire protection problem in the division the following appear to be the essentials for successful protection :—

(*a*) The application of *immediate* closure to all grazing, of areas in which serious fires have occurred. Any fire over 500 acres in extent can ordinarily be considered serious ;

(*b*) the fire-tracing of the common boundary between Government forests and *all* zamin and State forests, where it does not pass through shola forest ;

(*c*) the fire-tracing of important roads and paths through the forest which are frequently used ;

(*d*) the maintenance of fire lines along certain important ridges with a view to protecting sandal areas, fuel areas, and the catchment basins of important streams ;

(*e*) the maintenance of a close watch by all beat subordinates during the fire season over their beats, and the immediate putting out of all fires as soon as they are observed, either with the assistance of fire patrols for the smaller fires, or with the assistance of the nearest villagers under section 23 of the Forest Act ;

(*f*) the greater insistence, by frequent inspections, on the rule that all charcoal pits in fuel coupes should be fire-traced to a circumference of 30 feet round them ; and

(*g*) the closure to grazing during the periods of the plan of such of the hill grazing compartments as contain shola growth in the interests of extension of the sholas which are so important from the irrigation point of view. Such areas although they contain grass of sorts are too steep for cattle and no hardship will be caused to grazing interests as they are seldom if ever visited by village cattle.

231. *Regeneration areas.*—The special protection of regeneration areas such as fuel coupes is not advocated as the terrain in most of the ghat fuel series is so rugged that internal fire lines without a path alongside them would be of little use. Moreover the value of such forests does not justify excessive expenditure on special protection. Most of the fires in these areas of recent years have crossed over from adjacent zamin and State forests; all that is necessary therefore is to prevent this by maintaining adequately wide fire lines along the common boundaries between zamin and State forests on the one hand and Government forests on the other.

232. *Contributions.*—Some of the zamindars, for example, Chokkampatti and Tirumalainaickenpudukudi, are alive to the necessity for fire protection and have expressed their willingness to contribute cash or to provide labour for the maintenance of fire lines along their common boundaries. It is advisable that these contributions be put on a permanent basis. The Travancore State has also agreed to share half the cost of clearance of boundaries subject to the conditions set out in paragraph 33 above.

SECTION 3.—SPECIAL WORKS OF IMPROVEMENT UNDERTAKEN.

233. *Roads.*—The following statement gives a list of forest roads and bridle-paths constructed and maintained by the Forest department in the division with details of costs and year of construction. The roads have been classified according to their usefulness for extraction and inspection purposes during the period of the plan into three classes; the first consists of roads on which expenditure will have to be incurred annually for repairs; the second consists of roads which can ordinarily be maintained by subordinates but for which expenditure may have to be incurred periodically for special repairs; the last consists of roads which are so unimportant either for extraction or inspection purposes that no expenditure on them can be justified.

Serial number.	Description.	Length.		Cost of construction.		Year of construction.	Remarks.
		M.	F.	RS.	A.		
	A. Roads and Paths Requiring Regular Annual Repairs.						
	Srivilliputtur range—						
1	Mudangiar-Ayyanarkoil road ..	1	5½	1,649	12	1926–27	Earth road.
2	Talamalaiyankoil-Puliyuthu-Virusadi bridle-path	6	1	1,650	0	1893	Do.
3	Athithondu-Puliyuthu bridle-path.	4	2	500	0	1894	Connecting with No. 2.
4	Virusadi—Mudaliyaruthu bridle-path.	1	4	500	0	1897	Do.
5	Mudaliyaruthu—Chettiyar bridle-path	6	4	995	0	1905	
	Kuttalam range—						
6	Shenbagadevi bridle-path	4	3	1,088	0	1891–92	For use of pilgrims and inspection.
7	Tekkumalai bridle-path	2	3	157	0	Do.	Do.
8	Puckle's path in Kuttalam reserve ..	3	4	..		Do.	
	Ambasamudram range—						
9	Papanasam-Mundanthorai road ..	4	0	20,242 (Nos. 9 and 10)	0	1887–88	No. 9 is metalled. No. 10 is an earth road.
10	Mundanthorai-Kannikatti road ..	10	4				
11	Pechiammankoil-Kuduvarai road ..	8	2	1,993	0	1886–87 1898–99 1909–10	Earth road.
12	Mundanthorai-Kodamady-Kuttalam Kallaruvi road	10	2	2,318	0	1909–10 1913–14	Do.
13	Kariar-Karuthalipudai road ..	3	0	650	0	1894	Do.
14	Moolagajam-Taravittanparai road ..	2	5	665	0	1901	Do.
15	Bridle-path to Knapp's Hut	0	7	..		..	Continuation of No. 13. (Nos. 15–18)
16	Bridle-path from Knapp's Hut to Wood's Hut	2	4	..		..	
17	Bridle-path from Wood's Hut to Cox's Hut	10	0	..		..	
18	Bridle path from Cox's Hut to Kuduvarai	7	0	..		..	
19	Trace from Wood's Hut to Martin's Hut	6	3	..		..	Proposed to be converted into bridle-path.

Serial number.	Description.	Length. M.	F.	Cost of construction. RS.	A.	Year of construction.	Remarks.
	A. Roads and paths required regular annual repairs.—*cont.*						
20	Bridle-path from Martin's Hut to Kannikatty	7	0	..		..	
21	Bridle-path from Kannikatty to Kalivelipil	3	4	795	0	1897–98	About two milesi an earth cart-track.
	Nanguneri range—						
22	Kalakad-Sivanaperi road	1	1	648	0	1901	Metalled.
23	Sivanaperi-Mudalaruppan road ..	4	5	3,523	0	1884–85, 1899–00	Earth road.
24	Nadugani bridle-path	5	5	Transferred from Local Fund department.			Two miles have been converted into cart-track by contractors.
25	Bridle-path connecting Mudalaruppan, Sengalteri—Netterikal and Nambiar subordinates lines	17	5	3,148	0	1899–00	
26	Vadagarai-Arasapathu road and extension	5	2	2,437	0	1906–07, 1917–18.	Earth road.
27	Kopparai cart-track	2	4	1,025	0	1906–07	Do.
	B. Communications requiring periodical repairs.						
	Srivilliputtur range—						
28	Chittar-Vairavakan Shola—Khansapuram bridle-path	8	0	1,815	0	1910 and 1914.	
29	Ayyanarkoil- Chinna Vellakalteri Popuparai bridle-path	7	1	3,624	0	1893–94, 1903–04.	
30	Gundamanaickanur path	4	0	370	0	1913.	
	Kuttalam range—						
31	Budatarkoil bridle-path	2	1	1,750	0	1886–87.	
32	Milaparai-Puliyangudi road	1	5	300	0	1893.	Earth road.
33	Kotanteri road	3	3	4,040	0	1893–94.	Do.
34	Base lines in Vasudevanallur-re-reserve	7	6	396	0	1895–96	This is a cleared line.
35	Five Falls road	2	4	210	0	1901	
36	Krishnapuram valley bridle-path and Kuliratti cart-track	5	¾	1,014	0	1901, 1928–29	The cart-track is m. 0–2–7½ in length.
37	Kottamalai Ar bridle-path	3	0	29	0	1911–12	
38	Puliyangudi road	1	3½	429	0	1917–18	Earth road.
39	Vallam cart-track through old coupes 1—3 in Kuttalam Felling Series ..	2	4¾	2,085	0	1921–22, 1925	Do.
40	Approach to old Karuppasamikoil bungalow site	0	3	50	0	1896	Do.
1	Vallam revenue survey line	1	4	100	0	1895–96	
	Ambasamudram range—						
42	Branch road from road No. 13 to Kodamady rest house	0	4	266	0	1917–18	Earth road.
43	Thirthakarai road	2	4	500	0	1895–96	Do.
44	Cairns line road	2	4	755	0	1898–99	Do.
45	Aladiyur road in Koilteri Felling Series	2	4	By contractor.		1920–21	Do.
	Nanguneri range—						
46	Pachaiyar—Vadagarai revenue survey line	2	6	435	0	1904–05	
47	North cart-track from reserved forest boundary in Kalakad Felling Series	3	1½	2,525	0	1920–21	Earth road.
48	South cart-track from reserved forest boundary in Kalakad Felling Series	1	2½	2,500	0	1921–22	Do.
49	Tulukanparai bridle path	2	5	1,100	0	1909–10	
50	Mudalaruppan to Mungilpattikidai valley bridle-path	3	0	..		..	

Serial number.	Description.	Length.	Cost of construction.	Year of construction.	Remarks.
		M. F.	RS.		
	C COMMUNICATIONS TO BE WRITTEN OFF.				
	Srivilliputtur range—				
1	Cart-tracks in old coupes VII and VIII in Ayyanarkoil Felling Series ..	1 3	609 0	1926–27	
2	Cart-track in coupe IX, Ayyanarkoil Felling Series	0 3	466 0	1927–28	
3	Cart-track in coupe XI, Ayyanarkoil Felling Series.	0 5½	266 0	1929–30	
4	Cart-track in coupe X, Ayyanarkoil Felling Series	0 5	571 8	1928–29	
	Kuttalam range—				
5	Bridle-path from Budatarkoil to old Palayar Hut	3 0	..	..	
6	Kallimalai bridle-path	4 0	1,250 0	1893–94	
7	Nelliyuthu cart-track	3 4	626 0	1893–94	Earth road.
8	Road to old coupes VI and VII—Kuttalam Felling Series	1 4	594 0	1926–27	Do.
9	Road to old coupe IV, Kadayanallur.	0 6½	570 0	1926–27	Do.
10	Cart-track through coupes XXI and XXII, Puliyangudi Working Circle.	1 2	240 0	1927–28, 1928–29	
	Ambasamudram range—				
11	Thailathu odai trace	1 6	65 0	1918–19	
12	Thailathu bridle-path	0 2⅖	47 0	1916–17	
13	Road to old coupe XXVIII, Padarmalai Felling Series	0 4	1,158 8	1926–27	
14	Road to old coupe XXIX, Padarmalai Felling Series	0 7	683 0	1927–28	
15	Nathalodai trace	1 5	8 0	1920–21	
16	Ullar trace	0 5	50 0	1916–17	
17	Kalivelipil to Travancore boundary bridle-path	2 5	749 0	1897–98	
18	Kannikatty trace	1 3	50 0	1916–17	
	Nanguneri range—				
19	Kopparai bridle-path	1 ⅛	410 0	1907–08	
20	Branch road in old coupe IV, Kalakad Felling Series	0 2½	205 0	1922–23	
21	Cart-track connecting north and south cart-tracks in Kalakad Felling Series	0 2	75 0	1925–26	
22	Mudalaruppan to old coupe XXII, Kalakad Felling Series road ..	1 1	616 0	1909–10, 1911	Earth road.

No new roads are necessary as fuel working in the division has been well organized, most of the fuel felling series being in their second or third rotation. In the evergreen timber working circle the value of the growing stock does not justify the construction of roads, as not only will the construction and maintenance of roads in such rugged country be expensive but man handling of scantlings to the nearest cart-track has been found by experience to be the cheapest method of extraction.

234. *Buildings.*—The following statements give lists of buildings and wells constructed and maintained by the Forest Department in the division with details of costs and year of construction.

(i) List of Buildings.

Residential Buildings.

Serial number.	Description.	Year of construction.	Cost of construction
	Class I.		RS.
1	Range quarters at Srivilliputtur	1911	3,920
2	Do. at Kadayanallur	1893–94	3,345
3	Kodamady range quarters at Ambasamudram	1887–88	2,705
4	Kannikatti Do.	1925	3,996
5	Range quarters at Sivanaperi	1898–99	1,300
	Class II.		
	Srivilliputtur range—		
1	Subordinates' quarters at Mudangiar	1901	1,092
2	Do. at Athithondu	1893	787
3	Do. at Mudaliaruthu	1896	260
4	Do. at Pudupatti	1912	1,046
	Foresters' quarters at Pudupatti	1929–30	1,310

Serial number.	Description.	Year of construction.	Cost of construction.
			RS
	Residential Buildings—cont.		
	Class II—*cont.*		
	Kuttalam Range—		
6	Subordinates' quarters at Kuttalam	1895–96	375
7	Do. at Chellapuli	1909–10	2,030
8	Foresters' quarters at Chellapuli	1913	978
9	Subordinates' quarters at Melapuliyangudi	1916	1,816
	Ambasamudram Range—		
10	Forest Guards' quarters at Papanasam	1897–98	850
11	Foresters' quarters at Papanasam	1925	1,040
12	Subordinates' quarters at Pechiammankoil	1915–16	2,602
13	Do. at Kodamady	1925	2,181
14	Foresters' quarters at Kodamady	1916	1,179
15	Subordinates' quarters at Sivasailam	1912–13	1,882
16	Foresters' quarters at Mundanthorai	1894–95	643
17	Forest Guards' quarters at Mundanthorai	1903–04	800
18	Watchers' quarters at Mundanthorai	1914	2,354
19	Forest Guard's quarters at Kannikatti	1912–13	1,400
20	Cooly lines at Kannikatti	1922	989
	Nanguneri Range—		
21	Subordinates' quarters at Sivanapery	1908–09	1,023
22	Do. at Kovapatty	1887	485
23	Do. at Nambiar site	1916–17	1,787
	Non-residential Buildings.		
	Srivilliputtur Range—		
1	Range office at Srivilliputtur	1911	2,540
2	Rest-house at Mudangiar	1896	1,452
3	Do. at Athithondu	1894	1,623
4	Do. at Mudaliaruthu	1897	2,035
5	Do. at Pudupatti	1896	2,050
	Kuttalam Range—		
6	Range office at Kadayanallur	1896–97	643
7	Rest house at Kuttalam	1890–91	3,278
8	Range Inspection shed at Kuttalam	1896	200
9	Rest-house at Chellapuli	1911–12	1,345
10	Inspection bungalow at Naranapuram	1910–11	1,755
	Ambasamadram Range—		
11	Kodamady Range office at Ambasamudram	1887–88	300
12	Range Officers' Inspection shed at Papanasam	1897–99 and 1915–16	1,031
13	Range Officers' Inspection shed at Kodamadi	1915–16	870
14	Rest house at Kodamadi	1917–18	1,910
15	Cooly lines at Kodamadi	1922	940
16	Knapp's hut	1925	4,580
17	Wood's hut	1925	2,520
18	Cox's hut	1925	2,520
19	Rest-house at Sivasailam	1893–94	910
20	Range office, Kannikatty at Ambasamudram	1925	1,389
21	Rest-house at Mundanthorai	1892–93	2,758
22	Lower rest-house at Kannikatty	1889–90	2,420
23	Upper Do.	1925	7,070
24	Rangers' Inspection shed at Mundanthorai	1918–19 and 1921–22	1,951
25	Martin's hut at Kandavavarai	1925	2,694
	Nanguneri Range—		
26	Rest house at Sivanaperi	1888–89	2,051
27	Range office at Sivanaperi	1898–99	1,120
28	Rest house at Sengalteri	1906–07	3,867
29	Do. at Nadugani	1904–05	3,163
30	Do. at Vallanad	1893–94	1,195
31	Do. at Nazareth	1893–94	1,204

(ii) List of Wells.

	Srivilliputtur range—		
1	Well at Athithondu rest-house	1894	90
2	Do. at Pudupatti Do.	1896	100
3	Do. at Mudangiar Do.	1896	180
4	Do. at Range quarters, Srivilliputtur	1911	75
	Kuttalam range—		
5	Well at Range quarters, Kadayanallur	1896–97	150
6	Do. at Inspection bungalow, Naranapuram	1888–89	347
	Ambasamudram range—		
7	Well at Range quarters, Kodamady at Ambasamudram ..	1899	200
8	Do. at Sivasailam rest-house	1893–94	..
9	Do. at Range quarters, Kannikatty at Ambasamudram	1928–29	288
	Nanguneri Range—		
10	Well attached to rest-house at Sivanaperi	1901–02	151
11	Well at Nazareth bungalow	1893–94	..

The division is fairly well supplied with rest-houses; the construction of new quarters for subordinates is not recommended as it has been found that the subordinates rarely occupy even such of the existing subordinate quarters which are not close to villages, although rent is collected from them for occupation. Two inpection sheds, one in the Kariar valley of Ambasamudram Range, to facilitate inspection of the existing teak plantations prescribed in the clear felling working circle and another in the Ammankoil valley of Srivilliputtur Range to supervise the important regeneration operations prescribed in the Ayyanarkoil Timber cum fuel felling series, will be necessary.

SECTION 4.—PAST YIELDS.

235. *Forest Produce.*—The only big timber available in the division is evergreen timber. The various fuel series provide only small timber principally teak.

The following statement shows the quantities of timber and fuel marketed in the decade preceding the working plan :—

(1)	Timber in logs. (2)	Poles. (3)	Sawn or squared timber. (4)	Miscellaneous. (5)	Fuel. (6)
	C. FT.	C. FT.	C. FT.	C. FT.	C. FT.
1923–24	27·000	17,000	7,000	6,000	757,000
1924–25	4,000	2,000	2,000	31,000	436,000
1925–26	10,000	1,000	56,000	..	603,000
1926–27	11,000	6,000	15,000	28,000	539,000
1927–28	29,000	8,000	5,000	6,000	710,000
1928–29	81,000	4,000	17,000	3,000	821,000
1929–30	58,000	4,000	18,000	6,000	682,000
1930–31	70,000	1,000	17,000	3,000	580,000
1931–32	6,000	1,000	12,000	33,000	1,115,000
1932–33	..	8,000	..	31,000	2,552,000
Total	356,000	52,000	149,000	147,000	8795,000
Average ..	35,600	5,200	14,900	14,700	8,79,500

Since these figures are based on contractors accounts practically all extraction having been done through the agency of contractors, they can be said to be only approximately correct.

The yield from minor forest produce and bamboos is given in terms of money in para. 236 below.

SECTION 5.—PAST REVENUE.

236. *Revenue.*—The following statement shows the net revenue from various items of forest produce in the division during the past 10 years :—

Statement showing revenue under different heads—1923–24 to 1932–33.

Year. (1)	Timber. (2)	Fuel and charcoal. (3)	Bamboo. (4)	Sandal. (5)	Grazing and fodder grass. (6)	Other minor produce. (7)
	RS.	RS.	RS.	RS.	RS.	RS.
1923–24	1,485	1,44,419	987	814	13,023	35,714
1924–25	1,453	1,52,606	1,212	877	12,877	42.361
1925–26	2,305	1,69,843	2,314	920	13,615	39,699
1926–27	306	1,17,954	1,035	2,270	9,640	39,766
1927–28	539	1,09,980	790	1,650	9,284	34,939
1928–29	7,522	94,610	849	1,155	8,740	30,454
1929–30	4,619	110,740	899	5,769	7,442	29,615
1930–31	9,022	104,041	1,920	1,763	8,426	26,827
1931–32	7,042	65,959	1,071	6,031	7,286	21,272
1932–33	4,666	41,857	1,668	4,817	7,942	24,548
Total ..	38,959	11,12,009	12,765	26,066	98,275	325,195
Average ..	3,896	1,11,201	1,276	2,607	9,828	32,519

Year.	Confiscated produce. (8)	Miscellaneous. (9)	Totals. (10)	Refunds. (11)	Totals. (12)
	RS.	RS.	RS.	RS.	RS.
1923–24	398	10,894	2,07,734	201	2,07,533
1924–25	1,099	11,173	2,24,658	469	2,24,189
1925–26	1,333	10,119	2,40,148	138	2,40,010
1926–27	1,358	10,862	1,85,191	64	1,85,127
1927–28	1,228	12,656	1,71,066	34	1,71,032
1928–29	839	12,360	1,56,529	428	1,56,101
1929–30	1,669	11,785	1,72,538	350	1,72,188
1930–31	1,091	11,274	1,64,364	90	1,64,274
1931–32	1,644	18,248	1,23,553	155	1,23,398
1932–33	804	11,591	97,793	429	97,364
Total ..	11,463	1,15,962	17,43,574	2,358	17,41,216
Average ..	1,146	11,596	1,74,357	236	1,74,122

237. *Expenditure.*—The following statement shows the net expenditure incurred in the division under the different heads during the past 10 years.

Statement showing expenditure incurred from 1923–24 to 1932–33.

Year.	Roads.	Buildings.	Other works.	Departmental extraction.	By private agency.	Demarcation.	Cultural operations.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	RS.	RS.	RS.	RS.	RS.	RS.	RS.
1923–24	4,279	4,554	1,263	165	5,238	41	4,891
1924–25	4,837	10,131	2,423	— 18	5,374	561	2,740
1925–26	6,736	4,864	20	3,314	5,080	20	927
1926–27	7,849	3,710	570	315	4,872	15	1,175
1927–28	6,481	4,634	439	2,845	5,142	..	113
1928–29	5,950	3,788	943	12,834	6,355	50	851
1929–30	5,707	3,213	633	3,814	6,743	68	2,978
1930–31	6,127	3,597	359	6,296	6,890	3	2,941
1931–32	3,797	2,583	82	3,796	6,909	167	1,254
1932–33	4,054	2,889	301	847	6,488	81	1,895
Total ..	55,817	43,963	7,033	34,208	59,091	1,006	19,765
Average ..	5,582	4,396	703	3,421	5,909	101	1,976

Year.	Fire protection.	Establishment.	Allowances.	Contingencies.	Miscellaneous.	Total.
	(9)	(10)	(11)	(12)	(13)	(14)
	RS.	RS.	RS.	RS.	RS.	RS.
1923–24	1,574	63,123	8,355	2,026	1,089	96,598
1924–25	792	60,857	13,562	2,356	3,235	1,06,850
1925–26	856	64,253	11,263	2,306	596	1,00,235
1926–27	676	54,735	10,956	1,745	6,108	92,726
1927–28	574	57,886	8,911	2,143	2,610	91,778
1928–29	..	49,647	9,293	2,155	1,327	93,193
1929–30	343	47,809	7,658	2,100	2,103	83,169
1930–31	439	44,817	7,045	2,190	3,139	83,843
1931–32 — ..	389	44,492	6,596	2,023	1,265	73,353
1932–33	413	44,319	5,824	2,031	2,601	71,743
Total ..	6,056	5,31,938	89,463	21,075	24,073	8,93,488
Average ..	606	53,194	8,946	2,107	2,407	89,349

238. *The Surplus.*—The following statement shows the net surplus for the period 1923–24 to 1932–33 :—

Year.	Total revenue	Total expenditure.	Surplus.
	RS.	RS.	RS.
1923–24	2.07,533	96,598	1,10,935
1924–25	2,24,189	1,06,850	1,17,339
1925–26	2,40,010	1,00,235	1,39,775
1926–27	1,85,127	92,726	92,401
1927–28	1,71,032	91,778	79,254
1928–29	1,56,101	93,193	62,908
1929–30	1,72,188	83,169	89,019
1930–31	1,64,274	83,843	80,431
1931–32	1,23,398	73,353	50,045
1932–33	97,364	71,743	25,621
Total ..	17,41,216	8,93,488	8,47,728
Average ..	1,82,650	91,305	91,345

N.B.—The sudden fall in the surplus during 1931–32 is due to the effects of the prevailing agricultural depression. The figure for 1932–33 is not strictly comparable as owing to a change in the period of working of fuel coupes from the calendar to the official year, only half the fuel revenue for this year was credited in the accounts. This year has therefore been ignored in striking the average annual surplus.

CHAPTER VI.—STATISTICS OF GROWTH AND YIELD.

239. *Timber.*—The only big timber available in the division is evergreen timber. Since trees in evergreen forests have practically no break in the growing season, no annual rings are present. Statistics of growth can therefore be collected only by measurements of sample plots or trees over a period of years. No such measurements are available at present in Madras. In the absence of evergreen plantations of known age in the division the collection of reliable statistics is difficult.

240. *Small timber.*—With a view to discovering whether there was any financial justification for replacing the " Coppice with standard " system by the " Simple coppice " system, stem analysis of some of the principal deciduous species prevalent in the division was attempted. At the outset it was found that annual rings could not be distinguished with any degree of certainty on *Pterocarpus marsupium* on account of the heavy exudation of resin; sections of *Chloroxylon swietenia* split so badly after felling that measurements of diameters could not be made with accuracy although annual rings were clearly visible; sections of *Albizzia lebbek* showed *pseudo* rings and in some cases occluded bark. Teak alone lent itself admirably for stem analysis. It may be added however that the trees selected were not strictly comparable, as some showed distinct signs of suppression in early youth probably under standards or due to fires, while others owing to their sudden release from suppression caused by their retention as standards developed rapid girth increment for a period of years.

The following trees were ultimately stem analysed :—

Serial number and locality. (1)		Species. (2)	Girth at breast height in inches. (3)	Length of bole in feet. (4)	Total age in years. (5)	Volume in cubic feet. (6)
1	Kalakad Felling Series	Teak	33·75	18	60	4·7826
2	Do.	Do.	23·25	19½	50	3·2664
3	Do.	Do.	27·00	18	53	4·2924
4	Do.	Do.	24·00	19½	44	4·1802
5	Do.	Do.	34·00	33	50	9·7845
6	Do.	Do.	34·00	31½	65	10·0526
7	Do.	Do.	28·00	25	59	5·0882
8	Do.	Do.	33·75	27	68	9·9357
9	Mundanthorai plateau	Do.	43·25	39	64	15·7884
10	Do.	Do.	53·50	44	85	30·9034
11	Do.	Do.	46·00	39	64	22·9185
12	Do.	Do.	42·75	39	56	19·6599
13	Do.	Do.	37·50	39	55	13·7301
14	Do.	Do.	39·00	32	72	15·3064
15	Do.	Do.	42·00	27	80	11·6322
16	Do.	Do.	28·00	27	54	5·8962
17	Do.	Do.	37·50	21	45	10·0080
18	Do.	Do.	32·50	39	45	10·7287
19	Ayyanarkoil Felling Series ...	Do.	67·50	30	60	33·1356
20	Do.	Do.	51·50	36	45	24·5880
21	Do.	Do.	50·50	12	45	12·4134
22	Do.	Do.	52·75	36	45	22·1040
23	Do.	Do.	51·00	24	68	19·5126
24	Do. ...	Chloroxylon swietenia.	58·00	12	60	13·1412
25	Do. ...	Do.	51·00	12	66	13·2396
26	Do.	Teak	46·00	36	60	20·5506
27	Do.	Do.	45·00	24½	52	16·7478
28	Do.	Do.	55·00	18¾	70	18·0666
29	Do. ...	Albizzia lebbek ...	66·00	18¼	55	37·4928
30	Do.	Teak	38·00	29¾	52	13·5408
31	Do.	Do.	44·50	30⅓	55	15·3870
32	Do.	Do.	37·00	30½	65	14·4870

The average mean annual volume increment as revealed by stem analysis was 0·1500 cubic foot, 0·2525 cubic foot, and 0·3412 cubic foot for teak in the Kalakad felling series, the Mundanthorai plateau and the Ayyanarkoil felling series, respectively. The average mean annual breast height girth increment per annum was 0·53, 0·65 and 0·87 inches for teak in the Kalakad felling series, the Mundathorai plateau and the Ayyanarkoil felling series, respectively. Graphs of the mean annual increment were drawn and although no definite conclusions could be drawn from them, many of the curves showed a marked falling off of the mean annual increment between 35 and 45 years. The graphs are recorded in No. A. 297 of 1931 in the Working Plans Conservator's office.

241. *Conclusions.*—The mean annual increment, however, is not a good criterion for the determination of the financial rotation because teak under 25 inches mid-girth sells at Rs. 12 per ton or 4¼ annas per cubic foot of 50 lbs. while teak between 25 inches and 40 inches mid-girth sells at 10 annas a cubic foot. There is thus a marked price increment in the price once the 25 inches girth limit is passed. Considering the stunted

nature of the teak in our fuel felling series it may be assumed without appreciable error that teak poles are 12 feet in length on an average and hence the girth measurements at 6 feet alone need be considered.

From the graphs the following girth limits are attained at 30, 40 and 50 years, respectively :—

	Ayyanarkoil felling series.	Mundan-thorai plateau.	Kalakad felling series.
30 years—			
Minimum	16·81	14·30	9·42
Maximum	27·65	24·51	16·96
40 years—			
Minimum	22·00	19·47	13·51
Maximum	37·71	30·80	22·00
50 years—			
Minimum	28·60	23·87	18·27
Maximum	47·12	34·87	27·65

It will be seen that not even a 50-year rotation will give us a 25 inches tree in Kalakad felling series save in the most favoured localities; while at Mundanthorai and Ayyanarkoil, a very fair percentage of the crop at 40 years old would be over 25 inches in girth. On a 30-year rotation under the existing system, with the exception of a small percentage of the crop in the Ayyanarkoil felling series, no tree in the other localities would attain 25 inches in girth and hence the whole of the teak in the annual coupe with the exception of standards reserved in the last rotation will be saleable only at the lower rate of $4\frac{1}{4}$ annas a cubic foot. On a 40-year rotation, however, although the majority of the teak in the Kalakad felling series will still remain in the lower price class, a very fair percentage of the crop in the remaining localities will be in the higher price class. It only remains to be discussed whether the revenue from the standards on a 30-year rotation would compensate for the increased yield from simple coppice on a 40-year rotation.

The following table shows the anticipated yield from the various maxima and minima diameter classes on the assumption that only a 12-feet bole is obtainable from all trees :—

Rotation.	Ayyanarkoil felling series.			Mundanthorai plateau.			Kalakad felling series.		
	D.	B.A.	V.	D.	B.A.	V.	D.	B.A.	V.
30 years—									
Minimum ...	5·35	0·1561	1·8722	4·55	0·1129	1·3548	3·0	0·0491	0·5892
Maximum ...	8·80	0·4224	5·0688	7·88	0·3319	3·9728	5·4	0·1590	1·9080
40 years—									
Minimum ...	7·00	0·2673	3·2076	6·20	0·2096	2·5152	4·3	0·1009	1·2108
Maximum ...	12·00	0·7854	9·4248	9·80	0·5238	6·2856	7·0	0·2673	3·2018
50 years—									
Minimum ...	9·11	0·4517	5·4204	7·60	0·3151	3·7812	5·8	0·1835	2·2020
Maximum ...	15·00	1·2272	14·7264	11·10	0·6721	8·0652	8·8	0·4224	5·0688

N.B.—D.—Diameter in inches. B.A.—Basal area in square feet. V.—Volume in cubic feet.

Under the present system 15 to 20 standards are reserved per acre. The futility of reserving as standards, species other than teak is too obvious to need comment; in many of the fuel felling series even evergreens like *Aglaia Diospyros*, *Euginea* sp. are being reserved in spite of the fact that they are not timber species. On the assumption that 10 of the 20 standards reserved per acre are teak, (a very liberal estimate) the yield from standards on a 30-year rotation would be—

In Ayyanarkoil series—54 to 147 cubic feet per acre.

In Mundanthorai—38 to 80 cubic feet per acre.

In Kalakad series—22 to 50 cubic feet per acre.

On the assumption that all these standards would be over 25 inches girth at the time of felling (an assumption not justifiable in Kalakad felling series) the money yield per acre from standards would be—

In Ayyanarkoil series—540 to 1,470 annas per acre.

In Mundanthorai—380 to 800 annas per acre.

In Kalakad series—220 to 500 annas per acre.

On a ' Simple coppice ' rotation of 30 years this revenue can be obtained—

In Ayyanarkoil series from 127 to 346 trees.

In Mundanthorai from 90 to 130 trees.

In Kalakad series, 52 to 120 trees.

There is thus obviously some justification for the retention of the 'Coppice with standard' system on a 30-year rotation in all the localities as even at an espacement of 18 feet by 18 feet the number of trees per acre amounts only to 134. Let us consider a 'Simple coppice' rotation of 40 years; here, the volume of the standards can be easily obtained in all localities as shown below :—

	Ayyanarkoil series.	Mundanthorai.	Kalakad series.
	C.FT.	C.FT.	C.FT.
Minimum tree volume	3·2076	2·5152	1·2108
Maximum tree volume	9·4248	6·2856	3·2018
Average tree volume	6·3	4·4	2·2

The yield from standards can therefore be obtained in Ayyanarkoil series from 147/6 ·3=23 ·3 to 54/6 ·3=8 ·5, i.e., from 8 ·5 to 23 ·3 trees per acre. Similarly for Mundanthorai, 8 ·6 to 18 ·1 trees per acre and for Kalakad 10 to 22 ·7 trees per acre. It will thus be seen that these figures are well within the bounds of possibility and that a strong case even on financial grounds has been made out in favour of conversion to a 40-year simple coppice rotation on financial grounds. The case of working, the great reduction in friction between the department and contractors are also arguments in favour of the simple coppice system; in addition there is the possibility that the regenerative power of standard stools may be greatly reduced with age and that the standards themselves may cause serious suppression of the valuable coppice regeneration coming up under them as most of the deciduous species are strong light demanders.

242. *Teak plantations.*—The following table gives particulars of statistics collected by measurements of $\frac{1}{2}$ acre sample plots in the teak plantations in the division :—

Locality.	Year of formation.	Height of tallest tree in feet.	Height of smallest tree in feet.	Height of average tree in feet.	Girth at breast height of average tree.	Number of trees per acre.	Average breast height girth increment in inches per annum.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Kariar	1907	95	20	58	28·4	217	1·10
Do.	1912	105	45	72	30·4	224	1·44
Do.	1913	70	25	50	24.3	280	1·21
Do.	1914	52	15	40	15.2	196	0·80
Do.	1915	50	9	35	14·4	592	0.80
Do.	1922	50	7	39	13.2	684	1·20
Do.	1923	50	12	38	12·7	870	1.27
Do.	1924	48	7	38	12.7	884	1·41
Serviar	1917	46	10	38	15·6	706	0.97
Do.	1922	31	6·5	17·5	7·9	988	0·72
Do.	1923	41	7·5	25·5	10·6	744	1·06
Do.	1924	36	6	24	9.5	404	1·06

243. *Sandal.*—The following table gives an abstract of the average yield of final cleaned sandal in 6 inches girth classes during the period 1923–24 to 1932–33 :—

Girth classes.	0–6 inches.		6–12 inches.		12–18 inches.		18–24 inches.		24–30 inches.		30–36 inches.	
	Number of trees.	Yield in lbs.	Number of trees.	Yield in lbs.	Number of trees.	Yield in lbs.	Number of trees.	Yield in lbs.	Number of trees.	Yield in lbs.	Number of trees.	Yield in lbs.
	236	888	1,981	18,627	1,039	32,510	125	9,340	9	981	1	110
Average per tree.	3·75 lbs.		9·38 lbs.		31·31 lbs.		74·78 lbs.		109 lbs.		110 lbs.	

CHAPTER VII.—CAPITAL VALUE OF THE FOREST.

244. *General.*—It is difficult to form an accurate estimate of the capital value of the forest since all of it was acquired by Government under section 16 of the Forest Act. The average annual surplus however furnishes a fairly reliable basis for calculating the capital value of a forest estate. The following statement gives the total revenue and expenditure for the period 1872–73 to 1931–32, i.e., for 60 years.

Profit and loss statement.

Year.	Total Revenue.	Total Expenditure.	Surplus.	Deficit.
	RS.	RS.	RS.	RS.
1872–1873	16,819	13,533	3,286	...
1873–1874	18,978	13,053	5,925	...
1874–1875	16,597	15,086	1,511	...
1875–1876	16,602	19,759	...	3,157
1876–1877	Not available.			
1877–1878	23,733	22,199	1,534	...
1878–1879	25,751	26,697	...	946
1879–1880	21,834	31,023	...	9,189
1880–1881	Not available.			
1881–1882	24,132	27,088	...	2,956

Year.	Total Revenue.	Total Expenditure.	Surplus.	Deficit.
	RS.	RS.	RS.	RS.
1882–1883	35,639	25,219	10,420	...
1883–1884	36,912	41,567	...	4,655
1884–1885	44,002	39,857	4,145	...
1885–1886	40,119	35,436	4,683	...
1886–1887	54,573	46,881	7,692	...
1887–1888	56,794	45,996	10,798	...
1888–1889	63,372	47,682	15,690	...
1889–1890	79,660	51,625	28,035	...
1890–1891	81,457	52,223	29,234	...
1891–1892	84,717	51,165	33,552	...
1892–1893	96,462	99,993	...	3,531
1893–1894	85,486	68,757	16,729	...
1894–1895	89,344	74,963	14,381	...
1895–1896	89,024	62,916	26,108	...
1896–1897	87,670	53,168	34,502	...
1897–1898	81,126	62,375	18,751	...
1898–1899	95,968	63,012	32,956	...
1899–1900	84,473	54,891	29,582	...
1900–1901	74,002	49,342	24,660	...
1901–1902	78,548	55,664	22,884	...
1902–1903	74,736	55,377	19,359	...
1903–1904	1,08,822	50,998	57,824	...
1904–1905	1,14,033	54,120	59,913	...
1905–1906	94,931	56,889	38,042	...
1906–1907	1,11,741	59,069	52,672	...
1907–1908	1,20,579	55,138	65,441	...
1908–1909	1,38,397	62,546	75,851	...
1909–1910	1,51,807	70,846	80,961	...
1910–1911	1,41,053	69,642	71,411	...
1911–1912	1,33,885	76,921	56,964	...
1912–1913	1,36,612	66,095	70,517	...
1913–1914	1,40,296	69,787	70,509	...
1914–1915	1,19,902	76,831	43,071	...
1915–1916	1,24,924	71,060	53,864	...
1916–1917	1,45,364	62,257	83,107	...
1917–1918	1,49,939	67,708	82,231	...
1918–1919	1,54,309	70,413	83,896	...
1919–1920	1,84,559	75,381	1,09,178	...
1920–1921	1,64,901	66,521	98,380	...
1921–1922	2,05,417	1,08,667	96,750	...
1922–1933	2,34,714	90,925	1,43,789	...
1923–1924	2,07,533	96,598	1,10,935	...
1924–1925	2,24,189	1,07,272	1,16,917	...
1925–1926	2,40,010	1,00,447	1,39,563	...
1926–1927	1,80,857	92,926	87,931	...
1927–1928	1,71,032	91,778	79,254	...
1928–1929	1,54,946	93,193	61,753	...
1929–1930	1,66,419	83,169	83,250	...
1930–1931	1,62,511	83,843	78,668	...
1931–1932	1,17,367	73,343	44,024	...
		Total ...	26,93,083	24,434

The net annual surplus for the sextennium amounts to Rs. 26,68,649 or an average annual surplus of Rs. 44,477 exclusive of interest charges. Capitalizing this at 3 per cent interest which is the rate of borrowing on long term loans of Government, the capital value of the forest amounts to Rs. 14,82,567. Adding to this the capital cost of improvements in constructing buildings, wells, roads and paths which amounts to Rs. 1,86,726, the total capital value of the forest estate amounts to Rs. 16,69,293 or about Rs. 6·44 per acre.

PART II.

Future Management discussed and prescribed.

CHAPTER I.—BASIS OF PROPOSALS.

SECTION 1.—GENERAL OBJECTS OF MANAGEMENT.

245. The objects of management are—

(*a*) The exploitation, in conformity with silvicultural principles, and on the basis of a sustained annual yield, of such of the growing stock present in the forests of the division, namely, evergreen timber, small timber, fuel, sandal, bamboo and minor forest produce, as can be extracted at a profit.

(*b*) The regulation of the supply of fuel and small timber with particular reference to the requirements of villages and towns in the vicinity of the forests.

(*c*) The supply, conformably with well-established principles of conservancy, of the pastoral needs of the population.

(*d*) The protection of the catchment areas of all the important rivers and streams, on which the irrigation in the plains of the division depends.

(*e*) The maintenance of the forest in an increasing state of productivity by supplementing natural regeneration *artificially* where necessary, and converting suitable areas, clothed at present with a comparatively unremunerative type of growth such as semi-deciduous forest, into teak plantations.

(*f*) The production of the maximum financial return per acre of forest.

(*g*) The realization, to the fullest extent, of the indirect climatological benefits of forests, by promoting the natural spread of the forests by efficient fire protection.

(*h*) The preservation of such of the wild fauna of the division as are in danger of extinction; for example, ibex and bison.

246. These objects may be briefly classified under the following heads :—

(1) The exploitation of the forests on the principles of a sustained annual yield, so as to secure ultimately a normal series of age gradations, normally stocked.

(2) The discharge of the obligations of the state to the local population, in the matter of supplying the ryot with cheap fuel and small timber for agricultural purposes and house building, and sufficient pasturage for his cattle.

(3) The conservancy and improvement of the forest, with a view to regulate the flow of water in the important rivers and streams on which the vast irrigation system on the plains depends, and to render such forest ultimately exploitable.

SECTION 2.—METHOD OF TREATMENT.

247. *General.*—The details of the methods of treatment are elaborated under each working circle. Generally exploitation will be on an area basis, natural regeneration from coppice and seedling growth in the annual coupe being supplemented on a modest scale by artificial means. Briefly stated the methods of treatment to be adopted are, firstly, the harvesting of mature and over mature timber trees in the exploitable evergreen forests of the division, by a system of selection fellings which will maintain the evergreen character of these forests, and the artificial regeneration of gaps caused by fellings, with seedlings of timber species where necessary; secondly the division of the exploitable deciduous forest into two working circles, both worked under the *simple coppice* system, one set apart mainly for the production of small timber and the other mainly for fuel; coppice and seedling regeneration in both areas will be supplemented by rab sowing where necessary; thirdly, the sylvicultural treatment of existing teak plantations and the artificial introduction of teak in suitable areas in Ambasamudram and Kuttalam ranges; fourthly, the systematic extraction of dead sandal in the sandal area in Srivilliputtur range combined with the tending of the growing stock wherever it occurs, and the artificial introduction of sandal in suitable areas, *outside* the fuel working circles, wherever sandal is not present, by the method of " propagation centres "; fifthly, the provision for the disposal of minor forest produce by the sale of " farms "; sixthly, the supply of grazing facilities to the ryots under the permit system; seventhly, the carrying out of afforestation operations on the Kudiraimozhi Teri Reserve; and finally, the adequate

protection of the whole of the forests of the division from fire by a system of fire lines, reinforced by the employment of special fire patrols during the fire season and by constant vigilance on the part of the staff.

248. With the exception of sandal the ideal to be aimed at is to exploit all forest produce through the agency of contractors.

SECTION 3.—WORKING CIRCLES, THEIR AREA AND DISTRIBUTION; REASONS FOR THEIR CONSTITUTION.

249. Eight working circles have been formed as follows :—

(a) *The Evergreen Timber Working Circle.*—Area 2,959 acres. To this working circle are assigned all the exploitable shola areas in Ambasamudram, Nanguneri and Srivilliputtur ranges, exploitability being determined by the presence of four or more mature trees per acre, and further limited by the existence of extraction facilities and the possibility of constructing cheap extraction tracks within the areas. One felling series is formed in Ambasamudram Range although the exploitable areas are in three blocks, as contractors will find it easier to concentrate extraction operations in one locality, and a large coupe would better justify expenditure on roads. Besides, in the event of departmental extraction being resorted to, the concentration of extraction and regeneration operations in one locality will result in considerable economy of staff, labour, etc., and make adequate supervision easier. Two *reserve* felling series, one each in Nanguneri and Srivilliputtur Ranges, respectively, are proposed. The difficulty of extraction from these series renders their sale to contractors rather problematical especially in view of the prevailing trade depression. Their exploitation is therefore dependant on a rise in evergreen timber prices.

(b) *The Timber cum Fuel Working Circle.*—Area 20,550 acres. It comprises all exploitable deciduous forest areas capable of producing small timber on a rotation of 40 years. Most of the existing " coppice with standard " felling series have been included under this working circle, which has been divided into six felling series both as a means of distributing exploitation and regeneration operations over the various ranges, and in order to cater for the small timber requirements of neighbouring groups of villages and towns.

(c) *The Fuel Working Circle.*—Area 40,630 acres. To this has been allotted all the exploitable deciduous forest areas capable of producing mainly fuel with some small timber in the more favourable localities. The working circle has been divided into 22 felling series for similar reasons to those mentioned under (b).

(d) *The Clear Felling Working Circle.*—Area 802 acres. This includes all the existing teak plantations in the division as well as areas outside (b) and (c) which are suitable for conversion into teak plantations. The area planted up to date is so comparatively small that the formation of a separate Teak Plantation Working Circle is not considered advisable. Teak is one of the commonest indigenous species in the division and past experience has shown that it is possible to grow it in pure crops in suitable localities. The adoption of the clear felling and planting method can be fully justified only if it is confined to those areas which promise the very best prospects of the replacement of the existing miscellaneous forest by fully stocked teak plantations. To this end a careful examination of the forest has been made and the areas indicated above have been allotted to the Clear Felling Working Circle. The boundaries of the working circle were plotted on the maps by eye in the field, and show with a fair degree of accuracy the limits within which fairly successful teak plantations may be raised. The working circle has been divided into two felling series, one in Ambasamudram Range and the other in Kuttalam Range. This division has been made solely on grounds of convenience with a view to distribute the work of regeneration and exploitation annually over the two ranges.

(e) *The Sandal Working Circle.*—Area 4,742 acres of which 3,930 acres are in Srivilliputtur Range and 812 acres in Kuttalam Range. Sandal also occurs elsewhere in negligible quantities, for example, in Valliyur Reserve of Nanguneri Range, in the Padarmalai Felling Series and the Ramanadhi valley of Ambasamudram Range; it is not likely to be ripe for exploitation within the period of the working plan. Only one felling series—the Alagarkoil Felling Series—has been formed as the sandal growth elsewhere is too insignificant to be regularly worked.

(*f*) *The Minor Forest Produce Working Circle.*—In this working circle are included all the forests covered by this working plan. For administrative convenience the forests of each range will be an entity, and the system of further subdividing the range into a series of farms bounded by natural features will be continued as this arrangement has not only the force of long established custom behind it, but also tends to foster competition by reducing the size of the area leased, thereby increasing the field of bidders.

(*g*) *The Grazing Working Circle.*—Area 126,751 acres. This comprises all the forests covered by the working plan with the exception of (*a*) the evergreen forests and reed areas where no grazing exists, (*b*) areas permanently closed to grazing for the protection of bison, and (*c*) areas temporarily closed to grazing for silvicultural reasons, and (*d*) areas permanently closed to grazing for the protection of important catchment areas from fires and consequent denudation.

(*h*) *The Afforestation Working Circle* includes the whole of the Kudiraimozhi Teri Reserve. Area 11,371 acres. The peculiar problems to be tackled in the afforestation of these sandy wastes amply justify the formation of a separate working circle. The present division of the area into six so called felling series will be continued as it has been sanctioned by long established custom and any disturbance of the boundaries or change of the names of the series would lead to confusion.

(*i*) *Miscellaneous prescriptions.*—The bamboo areas in the division are both too small to be recognizable on a 1-inch scale map and too scattered. Their treatment will therefore be prescribed under this head.

The Valliyur Reserve in Nanguneri Range which is a partially reclaimed sandy waste with small extents of bamboo, mahogany and sandal, all artificially introduced, will also be dealt with under this chapter, as it would be difficult to justify its inclusion under any other working circle.

SECTION 4.—RECOMMENDATION OF THE ROYAL COMMISSION ON AGRICULTURE.

250. *General.*—The possibility of carrying out the recommendations of the Royal Commission on Agriculture will now be examined.

251. *Recommendation* 1.—" Schemes should be devised for the improvement of grasses grown in the forest and for the encouragement of grass cutting in preference to grazing." The improvement of forest grasses can be effected in two ways. First there is the natural process, where given good fire protection the forest tends to spread gradually and spontaneously, destroying in its progress the more luxuriant and less palatable grasses and encouraging the more palatable and nutritious grasses, for the optimum development of which, light wood land forest is the principal desideratum. This process is naturally slow, but has the great advantage of being inexpensive and also beneficial, both from the point of view of the grazier and the forest officer. Secondly there is the possibility of introducing artificially the more desirable strains of fodder grasses. In this division, this problem is particularly difficult as most of the outer slopes of the ghat forests are already pre-empted by the more important fuel felling series, and such of the areas as are not utilized for growing fuel, are practically useless for growing good grasses, the terrain being too rugged and stony to admit of ploughing, which is a *sine qua non* to the successful introduction of any good fodder grass. Until therefore, a suitable fodder grass, which can be successfully introduced in poor areas without preliminary ploughing, and which will spread rapidly and spontaneously, is discovered, the expense of artificially introducing grass in the forests of the division will not be justified by the results. The Kudiraimozhi Teri Reserve however is a comparatively flat expanse of land, the partially reclaimed portions of which may well prove ideal for growing grass. An additional advantage lies in the fact that it is at present permanently closed to grazing, and is practically devoid of herbivorous fauna, with the exception of some semi-wild cattle. The experimental introduction of *Pennisetum cenchroides* has already been attempted in this locality during 1932–33, but was a failure largely because sowings were made too late in the season. It is desirable that the experiment be repeated under more favourable auspices. On contiguous one-acre plots in the partially reclaimed portions of Nazareth Block, the cultivation of this, and any other suitable fodder grass will be attempted annually, and the results reviewed after five years, when the District Forest Officer, with the previous sanction of the Territorial Conservator, will abandon the experiment if unsuccessful, or increase the annual area to be planted up if this appears financially advisable. The method of introduction of the grass is summarized in Appendix VI to this plan.

252. With a view of encouraging grass cutting as an alternative to grazing the right to cut and remove fodder grass in all areas closed to grazing will be conceded free of charge for bona fide domestic purposes. This does not refer to areas closed to grazing on account of fires. The leasing out of this right in areas open to grazing, for *commercial* purposes will however be continued.

253. *Recommendation* 2.—" The grazing of inferior cattle in the reserves should be discouraged." This can only be done by the raising of the grazing fees, a procedure which would undoubtedly benefit the forest by reducing the incidence, and also improve the breed of cattle by making it uneconomic for the ryot to maintain the inferior cattle he now keeps. This, however, is directly opposed to the present policy of Government and on this ground alone is not recommended.

254. *Recommendation* 3.—" The intensity of grazing consistent with the proper development of the forest and the preservation of desirable grasses should be determined as soon as possible." The abolition of the block system of grazing and the fact that a grazing permit has been made valid over a whole district by Government Order has made the determination of the possibility in terms of cow units and the control of the intensity of grazing impracticable. The only alternative left to the Forest Officer is to close to grazing such portions of the forest where grazing would manifestly be undesirable, for example, regeneration areas and fire-burnt areas. The damage done by intensive grazing is both gradual and progressive, and hence not easily apparent, especially as owing to the exigencies of the service District Forest Officers have to be frequently transferred. It is therefore all the more regrettable that such damage cannot, under the present policy of Government, be prevented until the deterioration of the forest has gone so far as to be distinctly noticeable.

255. *Recommendation* 4.—" The initiation of new and the development of existing forest industries are matters of great importance to the agricultural population." The boiling of unfermented palmyra juice in order to convert it into jaggery is one of the principal agricultural industries in the division. For its development a cheap supply of *small sized* fuel is an essential. This will be catered for by permitting the removal of brushwood from the major portion of all fuel coupes according to the prevailing system.

256. *Recommendation* 5.—" All shifting cultivation should be brought under control with a view to the practice being stopped wherever it is productive of harmful results." The Kanis alluded to in paragraph 122 above are the only hill tribes who are addicted to shifting cultivation, and their activities on the right bank of Peyar in Ambasamudram Range require to be carefully watched. They have been allotted an area of 40 acres at the junction of the Peyar and the Tambraparni for cultivation. This concession will be continued. Under firm but kind treatment they are likely to be of use in the afforestation of this important catchment area of the Tambraparni and it is suggested that their habit of shifting cultivation be taken advantage of in the following manner :—

The 40-acre area already assigned to them may be divided into four 10-acre blocks, and each such block be given to them for cultivation for a period of two years. In the second year of cultivation of a particular block they will be supplied departmentally with seedlings or stumps of suitable evergreen timber species which they will plant out in their allotment, at an espacement which will not create hardship by reducing unduly the cultivable area. In case the 40-acre block already assigned to them has been fairly successfully afforested at the end of eight years, an additional 10 acres in the same locality will be given to them, their wishes in the matter of selection of the area being met as far as is reasonably possible. *Hopea parviflora* is the species which appears to hold out the greatest chance of success as it is already present in some of the older Kani clearings. The Kanis will on no account be allowed to practice shifting cultivation in any other locality, unless the previous sanction of the Chief Conservator of Forests has been obtained.

SECTION 5.—PERIOD OF THE WORKING PLAN—NECESSITY FOR INTERMEDIATE REVISION.

257. The period covered by this working plan is ten years from 1st April 1934 to 31st March 1944. The field work for the general revision should be undertaken not later than January 1943, so as to ensure that there will be no break in the continuity of controlled working. There will in all probability be no necessity for an intermediate revision.

CHAPTER II.—WORKING PLAN FOR THE EVERGREEN TIMBER WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

258. *General.*—In order to determine the area of evergreen shola that would lend itself to profitable exploitation, a preliminary reconnaissance was made during which blocks of suitable forest were selected. The boundaries of such blocks were further delimited by carrying out a 33-1/3 per cent strip enumeration survey of each block, alternate strips 4 chains wide, across the contours, being enumerated while an intermediate strip 8 chains wide was not enumerated. It was assumed that the unenumerated strip contained the same stocking as was present in the enumerated strips on either side of it. This is a great assumption to make when it is considered that many of the more valuable evergreen species exhibit a marked tendency to a gregariousness. However the only alternative was a cent per cent enumeration, and the cost of this was considered prohibitive in relation to the value of the growing stock.

259. *Previous enumeration results.*—The following table gives an abstract of the results of enumeration by the development party of 1923 of a block of 983 acres of shola forest in the Serviar valley west of the Usipothai Saddle in Ambasamudram range. It is of interest as it shows the specieswar and girthwar distribution of the growing stock in a typical exploitable shola of the division.

	Girth at breast height in feet.							
	1 – 3.	3 – 5.	5 – 6.	6 – 7.	7 – 8.	8 – 9.	9 – 10.	Over 10.
A class species.								
Acrocarpus fraxinifolius ..	326	238	84	67	55	48	38	27
Aglaia roxburghiana ..	2,380	1,642	388	142	35	13	11	1
Amoora rohituka	3,524	1,679	540	146	81	61	25	18
Anacolosa densiflora ..	1,347	1,405	446	250	82	36	28	14
Artocarpus sp.	522	563	176	130	45	18	15	8
Bischofia javanica	190	233	106	99	64	34	37	24
Balanocarpus utilis ..	616	321	128	63	40	20	7	16
Calophyllum trapezifolium ..	68	94	46	31	31	25	7	2
Chukrassia tabularis ..	149	117	54	27	16	21	19	7
Cullenia excelsa	3,833	3,444	1,854	1,555	949	556	322	200
Eugenia gardneri	211	81	29	4	4	2	1	..
Filicium decipiens	183	134	66	45	25	2	2	..
Garcinia echinocarpa ..	1,861	952	208	110	55	23	12	..
Gordonia obtusa	279	143	38	17	7	3	..	..
Gluta travancorica	1,708	1,805	922	806	463	328	181	103
Hardwickia pinnata ..	947	865	449	277	128	57	46	36
Hopea parviflora	1,635	817	236	128	79	31	18	34
Lansium anamalayanum ..	786	381	51	9	6	..	..	..
Mesua ferrea	2,8[illegible]6	2,181	804	582	365	196	105	70
Mimusops elengi	652	443	164	109	48	22	13	13
Pterospermum sp.	829	718	280	179	121	56	44	40
Palaquium ellipticum ..	4,552	4,940	2,645	1,967	969	439	234	108
Pygeum wightianum ..	286	253	82	63	37	19	15	2
Vitex altissima	282	413	194	236	136	48	21	30
B class species.								
Agrostistachys longifolia ..	6,749	1,601	102	14	3	..	..	..
Alstonia scholaris	175	62	20	12	8	4	1	11
Canarium strictum ..	664	608	283	253	160	106	81	66
Cinnamomum sp.	1,284	984	253	169	111	49	25	25
Diospyros sp.	14,349	6,854	1,225	565	151	52	8	3
Elæocarpus sp.	1,642	1,110	412	287	172	110	63	71
Eugenia sp. (excluding *Eugenia gardneri*).	3,431	2,304	647	486	310	168	69	79
Hydnocarpus sp.	1,430	304	30	18	1	..	..	..
Holigarna arnottiana ..	475	292	89	38	20	6	1	3
Machilus macrantha ..	254	137	42	20	13	4	1	..
Mangifera indica	309	155	39	26	20	9	7	9
Myristica sp.	1,881	1,005	279	107	31	25	2	1
Nephelium longanum ..	2,445	1,621	392	131	47	17	5	1
Notophegia colebrookiana ..	1,160	422	77	30	7	2	6	3
Stereospermum chelenoides ..	115	87	20	12	7	7	2	..
Terminalia belerica ..	142	122	66	79	48	31	42	42
C class species	12,111	4,302	743	233	105	61	32	36

The so called " C " class species such as *Ficus sp.*, *Holoptelia integrifolia*, *Maba buxifolia*, *Albizzia stipulata*, *Ormosia travancorica*, *Spondias mangifera*, *Cynometra travancorica*, *Phyllanthus sp.*, *Terminalia travancorica*, *Heritiera papilio*, *Sterculia sp.*, *Mallotus philippinensis*, *Baccaurea courtallensis*, *Macaranga roxburghii*, *Hemicyclia sp.*, etc , were assumed to be useful only for fuel.

260. *Working plan enumerations.*—In the course of preparation of this working plan enumerations referred to in paragraph 258 above were conducted, only marketable species being dealt with. The results are tabulated below :—

Knapps Hut Block.

Actual area enumerated—237·4 acres.

Species.	3-4′	4-5′	5-6′	6-7′	7-8′	8-9′	9-10′	10-11′	Over 11′
Acrocarpus fraxinifolius ..	..	..	..	1	5	8	..	3	..
Aglaia roxburghiana ..	104	68	53	31	16	2	3	..	1
Aglaia courtallensis ..	44	35	22	31	7	7	5	..	..
Anacolosa densiflora ..	211	142	80	44	11	1	1	..	..
Artocarpus integrifolia ..	93	49	27	8	6	..	1	..	..
Bischofia javanica	4	6	7	5	15	5	..	1	..
Calophyllum trapezifolium.	..	2	1	2	..	..	..	..	..
Cedrela toona	1	2	..	1	..	..	..	1	..
Chukrassia tabularis ..	1	..	..	1	..	..	..	..	..
Diospyros sp.	624	402	139	42	8	2	..	..	..
Dysoxylum malabaricum ..	7	4	4	7	5	1	..	1	1
Eugenia sp.	82	57	36	30	23	10	5	2	3
Filicium decipiens	4	5	1	..	..	..	..	..	..
Gluta travancorica	64	51	48	57	24	27	7	3	3
Hardkwickia pinnata ..	23	24	26	24	17	13	5	3	..
Heritiera papilio	10	6	11	5	1	3	1	..	..
Hopea parviflora	13	23	19	18	7	3	6	1	3
Mangifera indica	13	15	10	7	6	5	1	2	3
Mesua ferrea	188	145	137	112	71	32	10	3	4
Nephelium longanum ..	67	44	10	4	..	..	..	..	..
Palaquium ellipticum ..	328	294	263	141	75	31	19	2	..
Pterospermum rubigonosm.	21	30	27	17	8	3	5	3	1
Stereospermum chelenoides.	..	1	..	3	2	..	..	..	..
Vitex altissima	3	7	9	11	9	5	3	..	..

Palaquium, *Mesua*, *Anacolosa* and *Aglaia* are the predominant timber species in the crop.

Usipothai Block.

Actual area enumerated—92·6 acres.

Species.	3-4′	4-5′	5-6′	6-7′	7-8′	8-9′	9-10′	10-11′	Over 11′
Acrocarpus fraxinifolius ..	..	3	4	4	4	8	1	1	3
Aglaia roxburghiana ..	188	61	38	15	8	2	..	1	1
Aglaia courtallensis ..	3	4	1	3	1	..	1	..	..
Artocarpus sp.	15	12	20	7	3	7	7	..	..
Anacolosa densiflora ..	33	24	14	7	1	..	..	..	..
Balanocarpus utilis ..	15	9	9	5	8	3	..	2	1
Bischofia javanica	..	1	4	..	2	1	1	..	..
Cedrela toona	..	..	..	..	..	1	1	..	..
Diospyros sp.	374	201	58	21	2	..	..	..	..
Dysoxylum malabaricum ..	5	4	2	..	..	..	..	..	..
Eugenia sp.	3	3	3	..	..	..	..	..	..
Filicium decipiens	15	11	17	8	3	1	..	1	..
Gluta travancorica	47	38	39	34	16	1	1	1	..
Hardwickia pinnata ..	54	49	37	19	19	11	2	4	1
Heritiera papilio	13	4	5	3	..	..	1	..	..
Hopea parviflora	13	11	11	5	3	2	..	1	3
Mangifera indica	8	10	3	2	4	1	..	..	..
Mesua ferrea	121	110	71	65	25	13	7	7	..
Nephelium longanum ..	129	64	18	2	..	..	..	..	..
Palaquium ellipticum ..	12	7	5	6	2	..	1	1	..
Pterospermum rubigonosm.	39	44	47	41	23	9	3	2	1
Stereospermum chelenoides.	7	12	6	11	2	1	..	1	..
Vitex altissima	28	31	53	51	24	11	1	1	..

Part of this area is semi-deciduous, hence the comparatively large proportion of *Vitex* and *Stereospermum*. The area being quite accessible has also been most worked in the past.

Cox Hut Block.

Actual area enumerated—200·5 acres.

Species.	3-4′	4-5′	5-6′	6-7′	7-8′	8-9′	9-10′	10-11′	Over 11′
Acrocarpus fraxinifolius ..	..	..	1	2	3	4	1	2	..
Aglaia roxburghiana ..	102	69	31	18	13	8	2	1	..
Aglaia courtallensis ..	22	21	14	10	6	3	..	..	..
Anacolosa densiflora ..	47	38	14	7	1	..	..	..	..
Artocarpus sp.	40	16	5	5	2	2	..	..	..
Balanocarpus utilis ..	177	66	49	42	14	8	4	2	..
Bischofia javanica ..	14	13	11	9	8	5	6	7	2
Chukrassia tabularis ..	10	7	4	4	2	1	1	..	..
Diospyros sp.	368	160	87	30	5	2	..	..	..
Dysoxylum malabaricum ..	8	11	3	2	1	..	..	..	..
Eugenia sp.	68	54	35	28	14	10	9	7	2
Filicium decipiens ..	87	22	16	7	..	..	..	..	..
Gluta travancorica ..	60	50	30	36	21	9	4	1	2
Hardwickia pinnata ..	107	89	74	46	40	18	10	2	2

Cox Hut Block—cont.

Actual area enumerated—200·5 acres—*cont.*

Species.	3 – 4′	4 – 5′	5 – 6′	6 – 7′	7 – 8′	8 – 9′	9 – 10′	10 – 11′	Over 11′
Heritiera papilio	214	140	78	27	10	7	4	..	..
Hopea parviflora	38	25	12	10	7	4	3	1	1
Mangifera indica	218	138	91	99	68	46	21	19	8
Mesua ferrea	452	335	220	165	114	53	28	12	4
Nephelium longanum ..	217	83	26	7	2	..	..	..	..
Palaquium ellipticum ..	454	307	175	124	61	19	3	..	..
Pterospermum rubigonosm.	63	50	25	14	4	1	2	1	..
Stereospermum chelenoides.	12	15	4	5	3	1	1	1	..
Vitex altissima	85	68	42	36	17	6	2	..	..

This is a characteristic *Mesua-Palaquium* association above 2,500 feet, with *Mangifera* and *Heritiera* as congeners. At lower elevations *Balanocarpus*, *Vitex* and *Hardwickia* are the principal timber species.

Kannikatty Block.

Actual area enumerated—247·7 acres.

Species.	3 – 4′	4 – 5′	5 – 6′	6 – 7′	7 – 8′	8 – 9′	9 – 10′	10 – 11′	Over 11′
Aglaia roxburghiana ..	11	6	5	4	1	..	..	..	..
Anacolosa densiflora ..	28	13	5	2	1	..	..	..	..
Artocarpus sp.	99	46	20	7	2	..	..	..	..
Bischofia javanica ..	3	6	2	1	1	1	..	..	..
Calophyllum trapezifolium.	31	34	32	22	20	14	10	1	1
Cedrela toona	1	3	..	..	..	..	1	..	1
Diospyros sp.	329	173	74	19	2	1	..	..	..
Dysoxylum malabaricum ..	9	7	4	2	5	1	1	..	..
Eugenia sp.	115	66	43	16	11	6	1	3	..
Gluta travancorica	335	326	281	199	166	75	28	7	4
Heritiera papilio	7	16	7	8	3	1	..	..	..
Mesua ferrea	405	321	173	93	52	18	2	1	..
Nephelium longanum ..	30	14	4	3	1	..	..	..	..
Palaquium ellipticum ..	2,181	1,563	901	356	155	41	18	6	2
Vitex altissima	..	1	..	..	..	..	..	..	..

The *Gluta-Palaquium* and *Mesua-Palaquium* associations are the most typical ones to be met with on the area.

Sengalteri Block.

Actual area enumerated—268·9 acres.

Species.	3 – 4′	4 – 5′	5 – 6′	6 – 7′	7 – 8′	8 – 9′	9 – 10′	10 – 11′	Over 11′
Acrocarpus fraxinifolius ..	..	..	..	1	1	1	1	..	1
Artocarpus sp.	46	58	45	19	16	4	..	..	..
Bischofia javanica ..	3	3	4	3	3	4	..	1	1
Calophyllum trapezifolium.	31	36	36	26	30	17	1	4	4
Cedrela toona	..	1	2	..	1	1	..	3	2
Diospyros sp.	69	62	40	11	6	1	..	7	..
Dysoxylum malabaricum ..	4	2	3	6	1	1	1	1	1
Elæodendron sp.	19	22	33	12	11	12	12	5	8
Eugenia sp.	60	111	129	147	149	90	62	57	142
Heritiera papilio	27	41	42	33	18	6	9	1	4
Mangifera indica	119	100	91	79	77	59	26	25	52
Mesua ferrea	28	37	44	24	19	10	2	2	6
Nephelium longanum ..	105	120	103	43	17	4	1	1	..
Palaquium ellipticum ..	228	234	244	169	104	72	15	11	12
Vitex altissima	..	1	1	..	..	..	..	..	..

This block is characterized by the total absence of *Gluta travancorica* and *Aglaia roxburghiana*. It is composed principally of a *Palaquium-Mangifera* association. One other remarkable feature is the comparatively low stocking of the lower girth classes. This is probably due to the fact that these sholas were indiscriminately exploited in the past with the result that the canopy was too opened for the encouragement of natural regeneration of evergreen *timber* species which were accordingly replaced by inferior fast growing species. There is much overmature timber in the area especially *Palaquium ellipticum* and *Mangifera indica*, and this justifies the formation of a felling series. The difficulties of extraction combined with the depression in the prices of these timbers, render the formation of a *reserve* felling series only advisable.

Chittar Block.

Actual area enumerated—36·3 acres.

Species.	3 – 4′	4 – 5′	5 – 6′	6 – 7′	7 – 8′	8 – 9′	9 – 10′	10 – 11′	Over 11′
Acrocarpus fraxinifolius ..	2	3	5	2	6	..	4	3	4
Aglaia courtallensis ..	3	5	3	2	3	..	..	..	..
Artocarpus sp.	3	6	1	3	..	1	..	..	..
Bischofia javanica ..	4	1	5	5	8	4	5	5	1
Cedrela toona	1	8	3	4	4	3	5	3	1
Dysoxylum malabaricum ..	2	1	1	..	1	..	..	..	..
Elæodendron sp.	..	5	8	5	4	1	..	1	3
Eugenia sp-	3	7	5	7	5	7	1	1	1
Mangifera indica	7	5	2	6	2	4	3	..	3
Mesua ferrea	21	18	21	9	14	6	7	5	1
Nephelium longanum ..	7	12	11	1	1	..	..	..	..
Palaquium ellipticum ..	98	67	41	28	12	..	..	..	..
Vitex altissima	5	2	2	2	..	..	..	..	..

In addition the Vairavankavu shola, 99 acres has been partially enumerated but the growing stock together with the difficulties of extraction from this remote shola, do not render its exploitation advisable. Moreover this shola clothes part of the catchment area of the Periyar an important irrigation stream. The results of enumeration are however given in Appendix VIII to this plan.

261. *Character of the vegetation.*—The best shola forest in the division occurs in Ambasamudram range and this is due to the fact that the rainfall is heavier and spreads out over a longer period of the year. The Srivilliputtur sholas are definitely inferior as they do not receive the full benefit of the south-west monsoon.

262. *Division into felling series.*—The working circle will be divided into the following series :—

	ACS.
(1) The Ambasamudram Felling Series	2,118
(2) The Sengalteri Reserve Felling Series	655
(3) The Cittar Reserve Felling Series	186
Total ...	2,959

The reserve felling series being less accessible are expected to be exploitable only in case evergreen timber prices increase appreciably.

SECTION 2.—METHOD OF TREATMENT.

263. *Exploitable size.*—A scrutiny of the enumeration figures of the various blocks will show that there is a fairly sudden drop in the number of trees present in each girth class, and that the girth class in which this occurs is constant for groups of species. Since only trees which to all outward appearances were sound were enumerated, it may be reasonably concluded that unsoundness for a particular species synchronizes with this depression in stocking. No reliable figures based on actual past working of the percentage of unsoundness for each species in the various girth classes, are available. Departmental working was attempted only for two years on comparatively small areas and the number of trees and species extracted were so relatively small that it would be unwise to draw definite conclusions from this data. On the basis of the above arguments the exploitable size has been fixed empirically as below :—

Species	Size	Species	Size
Aglaia roxburghiana.	5 feet.	*Acrocarpus fraxinifolius.*	7 feet.
Aglaia courtallensis.		*Artocarpus integrifolia.*	
Nephelium longanum.		*Artocarpus hirsuta.*	
Anacolosa densiflora.	6 feet.	*Bischofia javanica.*	
Balanocarpus utilis.		*Cedrela toona.*	
Calophyllum trapezifolium.		*Dysoxylum malabaricum.*	
Chukrassia tabularis.		*Eugenia sp.*	
Diospyros sp.		*Elæodendron sp.*	
Heritiera papilio.		*Filicium decipiens.*	
Mangifera indica.		*Hardwickia pinnata.*	
Mesua ferrea.		*Hopea parviflora.*	
Palaquium ellipticum.		*Gluta travancorica.*	
Pterospermum rubigonosm.			
Stereospermum chelenoides.			
Vitex altissima.			

264. *Exploitable species.*—These comprise all the species which are at present saleable. Of these *Diospyros* is frequently rejected after felling owing to the presence of irregular masses of occluded bark in the heart wood; *Nephelium* is not a popular timber and only the very best trees are worth marking; *Mesua ferrea* is locally unpopular as it is frequently riddled by borers and owing to its hardness higher sawing charges have to be paid. Unless therefore this timber is converted into railway sleepers, and the contractor is assisted by us to dispose of them to the railway authorities, excessive marking of *Mesua* is to be deprecated. It has recently been ascertained that there is a demand for limited quantities of good *Canarium strictum*, for special purposes such as the runners on which the cages run up and down the mine shafts, in the Kolar Gold Fields. Good prices would be paid for suitable timber, and though this tree was not one of those enumerated for this working plan, nevertheless the figures abstracted, in paragraph 259 above, from the enumerations of the Development party in 1923, show that there are a large number of big trees in the forest. The District Forest Officer should therefore institute inquiries, through the Forest Utilization Officer, as to what the actual demand may be, and endeavour

to open up a market for this timber with the Kolar Gold Fields. The District Forest Officer, with the previous approval of the Territorial Conservator, may increase the number of exploitable species if such a course appears desirable. The exploitable girth of such species as well as of *Canarium strictum* if extracted will be fixed by the Territorial Conservator. If as a result of statistics obtained during the first five years of the plan it appears advisable to raise the girth limits for any species mentioned in the above list, the District Forest Officer will be authorized to do so with the previous sanction of the Territorial Conservator. Full reasons for such a step will be entered in the Control Journal. No *reduction* in the girth limit for any species will be effected without the previous sanction of the Chief Conservator of Forests being obtained.

265. *Silvicultural system.*—The silvicultural system to be adopted will be a modified " selection " system, under which trees of exploitable girth will be marked for felling, as far as possible evenly distributed over the annual coupe. The gaps caused by felling will be regenerated artificially where necessary.

266. *Regulation of the yield.*—Nothing definite can be known as to what constitutes normal stocking and a normal distribution of age classes in an evergreen forest, as :—

(*a*) we are dealing with a type of forest containing a great number of species, only relatively few of which are at present saleable,

(*b*) the silvicultural conditions governing the growth of the more valuable species as far as our present knowledge goes, are both varying for each species and in some degree mutually conflicting,

(*c*) any investigation into the number of years it takes, for a tree of one girth class to move on into the next higher girth class can at best be accomplished only by measurements of tree increment plots conducted over a series of years, as none of the evergreens show annual rings which can be distinctly recognizable as such, and hence stem analysis is impracticable. The situation is further complicated by the fact that the exploitable species are mixed with a large proportion of inferior species, and hence the effects of mutual suppression for varying periods cannot be accurately allowed for even in sample plot work, and

(*d*) the annual increment per acre is also put on, on favoured stems, many of which are unsaleable, the majority of the crop having to endure long periods of suppression until the fall of a big tree provides a suitable opportunity for growth. The volume increment is therefore neither even nor constant, save under the most favourable conditions.

This being the case any regulation of the yield by volume is not feasible. The only alternative is to regulate the yield on an area basis, and to ensure, that not more than the possibility is felled by the imposition of a high girth limit, and that the essential character of these forests is not altered, by restricting exploitation to the smallest number of trees per acre that would make extraction remunerative enough to provide funds for the regeneration and improvement of the forests.

267. *Felling cycle.*—A scrutiny of the enumeration figures will show that there is a relatively large amount of overmature timber in the forest. It seems desirable therefore to remove this stock in the shortest time consistent with market demand, transport facilities and availability of staff and labour supply. As mentioned in paragraph 79 above, between 30,000 and 40,000 cubic feet of evergreen timber can be absorbed locally under normal conditions. In view of the urgency of removing overmature stock from the forest before it deteriorates further, a short felling cycle is indicated. A ten-year felling cycle would give an annual yield of about 35,000 cubic feet and an annual coupe of about 225 acres in the Ambasamudram Felling Series. Both from the point of view of demand and the control of extraction and regeneration, this cycle appears to be suitable and is therefore prescribed. Owing to the small size of the Cittar Reserve Felling Series a five-year cycle will be prescribed here, as a smaller coupe would be unremunerative to work.

268. *Division into annual coupes.*—Each felling series has been accordingly divided into 10 annual coupes, except the Cittar Reserve Felling Series which is divided into five annual coupes.

SECTION 3.—METHOD OF EXECUTION OF THE FELLINGS.

269. *Demarcation.*—The annual coupe will be laid out on the ground with reference to the felling series map, the perimeter of the coupe being cleared to a width of 6 feet except where a river or stream forms a natural boundary. The coupe shall be correctly demarcated by an officer not below the rank of a forester. The demarcation will be undertaken towards the end of the south-west monsoon and completed by the end of September at the latest. The four principal corners of each coupe will be marked by cut stones showing the coupe number and the year of felling.

270. *Marking.*—The trees to be felled will be of the species, and of above the exploitable girths, mentioned in paragraph 263 above. The marking officer who should be of or above the rank of Range Officer will observe the following rules :—

(*a*) The trees marked for felling will be as far as possible evenly distributed over the annual coupe.

(*b*) Not more than three trees will be marked on *any one acre*, i.e., one marked tree should be not less than 120 feet away from its nearest neighbour. This rule may however be relaxed in cases where two exploitable trees standing close together are likely to cause only one gap on being felled, when both trees may be marked for felling.

(*c*) In cases where there is a doubt as to which of two or more trees in a patch should be felled, the one which in the opinion of the marking officer is least likely to keep sound for another felling cycle should be marked.

(*d*) No tree incapable of yielding at least 25 cubic feet of timber should be marked for felling; subject to this proviso partially unsound trees may be marked.

(*e*) All trees selected for felling will be given a serial number which will be marked in tar both at breast height and on the base of the tree.

(*f*) All large climbers met with in the annual coupe in the course of marking operations, will be cut.

(*g*) A list of marked trees will be prepared by the marking officer in Form 3.

(*h*) A sketch of the coupe on a scale of 16 inches to 1 mile will be prepared by enlargement from the 4 inches map and on it the marking officer will show the approximate position of each tree in the coupe. For this purpose he will be provided with a pocket compass and will judge the distance between trees by stepping.

(*i*) The marking list together with the coupe map referred to above will be submitted to the District Forest Officer before the middle of October, and the latter will check such proportion of the marking as will enable him to certify that it has been done in accordance with the rules.

(*j*) At the time of marking all selected trees will be clearly hammer marked both at stump and at breast height with the Range Officer's hammer.

271. *Exploitation.*—The method of executing the fellings will be left to the discretion of the District Forest Officer. The present method of felling the marked trees standing to contractors has been in practice for a couple of years over comparatively small coupes, and it is recommended that it be continued. The outstanding advantage of the method is, that the staff is freed from the responsibility of exploitation, stock-taking and disposal of the produce, maintenance of accounts, etc., and their attention can be concentrated on the important work of regeneration. In case the coupes are to be sold to contractors the sales will be held in November; the method of sale may advantageously be that advocated in paragraph 109 above, as in the first year's at least, it will be necessary to protect the contractor from loss in order to popularise the system of working. The period of contract will be the calendar year as owing to the presence of two monsoons during which felling and extraction in the evergreens is not possible, such work can only be done from about the 15th of February to the end of May and from the middle of August to about the end of October.

In the event of departmental extraction being decided upon, in any of the coupes of the Ambasamudram Felling Series, owing to the prices offered by contractors being too small, or for any other reason, budgetary provision will be necessary and the work of exploitation may have to be postponed to the next calendar year. The sequence of coupes alone is therefore fixed and not the year of working.

272. *Charcoal burning.*—With a view to increasing the revenue from the annual coupe, and also of providing a clean forest floor for regeneration operations, the conversion of top ends and unserviceable portions of timber trees into charcoal has been advocated. There is little doubt that there is a demand for charcoal in the division, and bids for the annual coupe might well be higher if charcoal burning were permitted. The effect of such burning on the surrounding growth and also on the productivity of the soil in the immediate vicinity of the charcoal pits is not known. Since it may transpire that such burning may be prejudicial to artificial and natural regeneration, it appears advisable to restrict such operation until our knowledge on the subject is increased.

Charcoal burning will therefore be permitted only on a maximum of 25 per cent of the gaps caused by felling. All such gaps will be specially distinguished on the coupe map. At the end of five years working the results will be reviewed by the District Forest Officer, and the latter, with the previous sanction of the Territorial Conservator, will either extend the operation or restrict it according to circumstances. Besides financial

considerations, the advantages of having a clean forest floor so as to facilitate inspection and minimise danger from fungus and insect attack, are appreciable; also it may well be found that artificial regeneration is assisted by the burning; the conversion of the debris from felling into charcoal should therefore not be abandoned without full trial and due consideration.

SECTION 4.—TABULAR STATEMENT OF FELLINGS.

273. *Felling Plan.*—The following table gives the statement of fellings :—

Ambasamudram Felling Series.				Chittar Reserve Felling Series.				Sengalteri Reserve Felling Series.			
Coupe number.	Area in acres.	Total number of exploitable trees.	Possibility.	Coupe number.	Area in acres.	Total number of exploitable trees.	Possibility.	Coupe number.	Area in acres.	Total number of exploitable trees.	Possibility.
I	206	1,053	515	I	36		90	I	69		172
II	218	1,391	545	II	38		95	II	66		165
III	222	1,702	555	III	37		92	III	68		170
VII	191	962	477	IV	37		92	IV	67		167
VIII	184	1,033	460	V	38		95	V	68		170
IX	196	629	490	I	36	1,015	90	VI	68	4,005	170
X	176	743	440	II	38		95	VII	71		177
IV	238	1,392	595	III	37		92	VIII	75		187
V	261	1,152	650	IV	37		92	IX	52		127
VI	226	926	565	V	38		95	X	51		130
	2,118	10,983	5,292		372		928		655		1,635

N.B.—The possibility has been calculated on the basis of 2·5 trees to the acre.

SECTION 5.—SUBSIDIARY SILVICULTURAL REGULATIONS.

274. *Tending natural regeneration.*—That there is a considerable amount of young natural regeneration present in the annual coupes, is amply borne out by the enumeration statements tabulated in paragraph 198 above. Such regeneration stagnates for varying and sometimes considerable periods until a gap in the canopy admits sufficient light to enable it to shoot up. Little is known as regards the light requirements of such seedling growth, but such research as has been done on the subject, points unmistakably to the fact, that a light opening of the canopy immediately above regeneration of the more valuable species is definitely beneficial. The work however requires not only a good knowledge of the seedling stages of the various species, but also a high degree of silvicultural skill on the part of the officer conducting the operation. This naturally restricts the scope of tending operations. Their value also from the point of view of the increment they stimulate is at present controversial. For these reasons it is desirable to restrict the extent of such operations. It is accordingly prescribed that the canopy be opened over natural seedling and young pole regeneration, under the personal supervision of the District Forest Officer or his gazetted assistant, over an area of not less than 25 acres annually in the coupe under exploitation, the area over which such tending is conducted being marked on the coupe map. This opening must be done cautiously to begin with, as we know nothing about the extent to which light ought to be admitted, and the upper storey must not be interfered with until some experience has been obtained. The expense of such operations is not expected to exceed the cost of four coolies per acre. The work is best done just before the south-west monsoon and will be restricted to the coupes in the Ambasamudram Felling Series. The cutting of climbers in the years coupe will be done at the time of marking for felling as prescribed in paragraph 270 above.

275. *Artificial regeneration of gaps.*—The gaps caused by felling vary in size from approximately a ¼ square chain to ¾ of a square chain according to the size of the tree felled. The sawyers generally cut back all existing seedling growth that exists in the gap in order to facilitate their work, and the crown of the falling tree damages the rest. It does not appear necessary to regenerate gaps less than 100 square yards in extent as the gap tends to close up in a couple of years, before the regeneration in it has a chance of establishing itself. Only gaps over 100 square yards in extent and not less than 7 to 8 yards in width will therefore be regenerated artificially.

Again it frequently happens that owing to the presence of adjacent seed bearers especially of *Acrocarpus*, *Palaquium* and *Gluta*, a gap is filled with sufficient regeneration naturally. Such gaps need not be regenerated artificially.

Artificial regeneration is of two kinds, dibbling of seed and transplanting of seedlings. Given good seed and timely dibbling there is little to choose between the methods. Species like *Hopea parviflora* and *Dipterocarpus bourdilloni* rapidly lose their germinative capacity on storage, while *Dysoxylum* seed have too many insect enemies; hence transplanting from a nursery in the case of such species is the safest course. *Gluta*, *Palaquium*, *Acrocarpus*, *Chukrassia* and *Aglaia* can be successfully raised by dibbling.

276. *Method of regeneration.*—The Range Officer will inspect all gaps caused by felling in the annual coupe and mark with tin plates bearing the serial number of the tree, the gaps which need to be regenerated artificially—vide paragraph 275; such gaps will be specially distinguished on the 16 inches to 1 mile scale coupe map and the work will be completed by the end of January following the year of exploitation. All these gaps will be staked at a rough espacement of 6 feet by 6 feet and regenerated as follows :—

Dibbling.—Dibbling should, as far as possible be completed by the 31st May, seeds that are not then ripe being sown as soon as they become available. Experiment, in these forests, has shown that—

(*a*) *Balanocarpus utilis* seed should be dibbled only in gaps below 1,500 feet elevation as this species does not thrive in its natural state above this elevation.

(*b*) Seeds of *Hopea parviflora*, *Dipterocarpus bourdilloni* and *Dysoxylum malabaricum* if dibbled must be treated with exceptional care, it being borne in mind that the first two lose their germination capacity within a few days, and the last is very subject to attack by insects and vermin.

(*c*) Seeds of *Acrocarpus fraxinifolius*, *Artocarpus hirsuta* and *Cedrela toona* should be dibbled in the centre of the gaps where there is most light, while seeds of *Gluta travancorica* and *Palaquium ellipticum* should be dibbled on the periphery of the gap where there is good shade.

(*d*) Seeds of *Mesua ferrea* should not be used in artificial regeneration operations as this species is almost invariably attacked by borers. There is also a sufficiency of natural regeneration of this species, scattered over the forest.

(*e*) Seeds of *Gluta* and *Palaquium* should not be dibbled in gaps below 2,500 feet elevation as these species thrive naturally only above this elevation.

(*f*) In the case of *Artocarpus hirsuta* the ripe fruit should be collected from the tree (there are numerous seed bearers along the upper reaches of the Kal Ar in the Sivaisalem forests) and the freshly pulped seed sown direct with the minimum of delay in the gaps. It is however preferable to raise seedlings of this species in a nursery as the seed is a favourite food of squirrels, monkeys and rodents.

(*g*) Dibbling is best effected by making a shallow saucer-like depression near each stake and refilling it with the same soil after having removed the undecomposed humus, and then putting 5 to 15 seeds in each such little bed according to the size of the seed and its germinative capacity. The seed should be lightly covered with a layer of humus and soil equal to half the thickness of the seed.

Transplanting.—It is not advisable to experiment with too many species in transplanting operations as nursery practice becomes involved, and it becomes difficult to gauge the success or otherwise of operations. Only a few species should be raised in nurseries according to the availability of seed and the elevation of gaps to be regenerated. The following are recommended :—

(1) *Acrocarpus fraxinifolius.*
(2) *Aglaia roxburghiana.*
(3) *Artocarpus hirsuta.*
(4) *Balanocarpus utilis.*
(5) *Cedrela toona.*
(6) *Chukrassia tabularis.*
(7) *Dipterocarpus bourdilloni.*
(8) *Dysoxylum malabaricum.*
(9) *Filicium decipiens.*
(10) *Gluta travancorica.*
(11) *Hardwickia pinnata.*
(12) *Heretiera papilio.*
(13) *Hopea parviflora.*
(14) *Palaquium ellipticum.*

Transplanting is best effected in June, at the beginning of the south-west monsoon and nursery work should be started in the previous July or as early after this as possible, so that seedlings of sufficient age may be available for transplanting.

The following rules for transplanting should be observed :—

(*a*) *Balanocarpus* seedlings should not be introduced above 1,500 feet elevation, *Hopea*, *Dipterocarpus bourdilloni* above 2,500 feet elevation, and *Acrocarpus* and *Filicium decipiens* above 3,000 feet elevation.

(*b*) *Acrocarpus* and *Artocarpus hirsuta* should be introduced in the centre of a gap, *Gluta*, *Palaquium* and *Hopea* on the periphery of the gap. The other species may be introduced intermediately.

277. *Nursery practice.*—Attention is invited to paragraph 195 supra where the information collected so far on nursery practice is given. The following suggestions are made as to the most suitable way of forming the nursery. The Provincial Silviculturist should

be consulted in this matter periodically. Open nurseries have been found to be of definite advantage as far as the plant percent, and the success of transplants are concerned, but have the distinct disadvantage of requiring shade over the beds and daily watering during the dry weather. Shola nurseries on the other hand require no watering (except of the seed beds to promote germination) but the plants raised do not appear to be so healthy having either etiolated or leathery leaves. It is suggested therefore that a via media between the two types be adopted, by having a rectangular open nursery the longer sides running north and south, and the shorter side being not more than a chain wide. Such a nursery would be in direct sun light for the shortest possible time.

Raised beds of convenient length, 3 feet wide, running along the contours, are best, and it is convenient to have only one species sown in each bed. The nursery should be fenced adequately, a fence with close set hardwood supports closely interlaced with reed, being the best fence.

Seed should be collected in time, the defective seed rejected, and the balance sown closely in the beds with the minimum of delay in furrows 4 inches apart made preferably by the finger, the depth of the furrow not exceeding the thickness of the seed. The seed should be covered with a thin layer of leaf mould, and should be watered daily in the absence of rain, with a watering can having a very fine spray, until germination sets in. After this watering will be necessary only if the plants show signs of wilting.

The size of the nursery will depend on the number of plants required. On the assumption that 60 per cent of the gaps will require to be regenerated, the following table shows the number of annual gaps :—

Name of felling series.	Approximate average maximum number of trees that can be felled.	Number of gaps requiring re-generation.
Ambasamudram	530	318
Sengalteri Reserve	165	99
Chittar Reserve	90	54

Supposing that 50 per cent of the necessary regeneration is successfully obtained by dibbling, and further supposing that each gap is on an average ½ square chain in extent, 30 seedlings will be required per gap at an espacement of 6 feet by 6 feet. The annual requirements would therefore be—

(1) Ambasamudram Felling Series.—9,540 seedlings.

(2) Sengalteri Felling Series.—2,970 seedlings.

(3) Chittar Felling Series.—1,620 seedlings.

The size of the nursery at each locality will be adjusted accordingly. In order to save transport charges it is preferable to have a nursery in each annual coupe. If this is done, it is prescribed that a sufficient number of plants at suitable espacement be retained in the nursery, so that abandoned nurseries may be afforested with useful species. Further this would give the revising officer valuable data as to the rate of growth of various species in admixture and also indicate whether the raising of mixed even-aged plantations of evergreens is possible.

278. *Costs.*—The average expenditure for similar regeneration work done in the past amounts to 10 annas per gap inclusive of nursery charges. A great proportion of the work was done by subordinates free of cost; this will not be possible in the large scale operations contemplated under this plan. Provision is therefore made for a total expenditure of 12 annas per gap or Rs. 1–8–0 per acre which should cover all operations undertaken during the year of formation.

279. *First year tending.*—In the year following dibbling or transplanting operations a light tending is necessary. This consists in cutting out grass, weeds and inferior species interfering with the growth of the seedlings and light soil æration. The operation is best done in June during the south-west monsoon and again if necessary in October-November during the north-east monsoon. The cost of this operation is expected to be 8 annas per gap or Re. 1 per acre on the basis of 2 gaps per acre for both operations.

280. *Second year tending.*—In the succeeding year a similar tending will be done during the south-west monsoon and is expected to cost 4 annas per gap or 8 annas per acre. No further tending is prescribed.

SECTION 6.—OTHER REGULATIONS.

281. *Grazing.*—The whole of the working circle will be closed to grazing.

282. *Fire protection.*—The working circle is seldom visited by fires, such fires as do occur being due to the carelessness of coolies of the minor forest produce contractor. The collection of dammar from *Canarium strictum* or *Vateria indica* by the use of fire will be strictly prohibited. All charcoal pits will have inflammable material round them removed for a radius of 20 feet and a clause to the effect that the contractor will be held responsible for all fires that occur in the annual coupe will be entered in all contracts. No special protection of the working circle from fire is necessary.

283. *Collection and record of statistics.*—In the event of extraction being effected through the agency of contractors, the Range Officer will hammer mark all scantlings into which a tree has been converted at stump site before removal. He will maintain accurate records of the outturn from each tree in Form 3.

284. *Inspection paths.*—These shall be maintained inside the coupe under working so as to join all the gaps under regeneration, in order to facilitate inspection and tending. Their maintenance for two years will be a matter for the local staff.

285. *Evergreen plantations.*—It is realized that the method of 'gap' regeneration, advocated above for this working circle, can at best be considered only as a temporary phase in the proper management of these forests, and it is prescribed primarily with the object of making sure of replacing with something better, the over-mature stock which has to be removed from the forest before it deteriorates further. But there is no special virtue in perpetuating the conditions under which selection fellings, always the most expensive form of exploitation, are essential. The possibility of concentrating the saleable evergreen species in localities favourably situated from the point of view of extraction, by the raising of even aged plantations of such species, therefore merits consideration. The gaps created in the course of selection fellings are found to regenerate naturally and with rapidity, a part of such natural regeneration being often of the valuable species; there is therefore no danger of the essential character of the forest being changed by exploitation as carried out by the methods prescribed, even though the individual gaps are not regenerated artificially. Plantations, of only such species as are saleable, along favourable extraction routes, have many advantages over gap regeneration. For instance :—

(*a*) Their silvicultural treatment would be easier and more economical.

(*b*) In the absence of long periods of suppression by the less valuable species, the growth in the plantations would in all probability be much more rapid than in gaps.

(*c*) The costs of extraction from the plantations at maturity, would be considerably reduced.

Very little is known at present as to the technique of raising such plantations and experiments in this direction are eminently desirable.

It is accordingly prescribed that a block of 10 acres in evergreen forest, be selected by the District Forest Officer, preferably in the Ullar valley along the Mundanthorai-Kannikatty Road, and set apart for evergreen plantations during the period of the working plan. An area of not more than 1 acre will be felled annually, attempts being made to sell the growing stock standing to contractors. It is suggested that the area selected be not more than 2½ chains wide in a east to west direction, so that exposure to direct sun light may be minimized. The material left after removal of all saleable fuel charcoal and timber, will be burnt departmentally and the area staked at an espacement of 6 feet by 6 feet. As soon as the south-west monsoon has burst the area will be planted up departmentally with a mixture of any or all of the following species :—

(1) *Hopea parviflora.* (3) *Acrocarpus fraxinifolius.*
(2) *Dipterocarpus bourdilloni.* (4) *Artocarpus hirsuta.*

The method of mixture will be left to the discretion of the District Forest Officer in consultation with the Provincial Silviculturist. The tending and replacing of casualities in the year of formation will be attended to by the local subordinates. The results of the experiment with costs, will be recorded annually in the Control Journal for the working circle.

SECTION 7.—CONTROL.

286. *Control records.*—The prescriptions of the working plan will be controlled by the maintenance of the following control records :—

(*a*) Control book.
(*b*) Record of works.
(*c*) Control Journal.
(*d*) Regeneration ledger.
(*e*) Control maps.

The District Forest Officer will be personally responsible for the correct posting of all control forms and maps.

287. *Control book.*—The control book shall consist of a bound book containing a sufficient number of forms prescribed. The prescriptions of the working plan showing the locality to be exploited, and the result of operations showing the locality actually exploited, the yield, etc., will be entered in the appropriate columns. Deviations from the prescriptions shall be briefly explained in the remarks column, the authority being invariably quoted. A sample form is given in Appendix IX.

288. *Record of works.*—All works other than exploitation shall be controlled in the record of works. The prescriptions of the working plan and the operations actually carried out will be entered in the appropriate columns. In addition measures suggested in the working plan with results of operations, as well as measures neither prescribed nor suggested but carried out, with results of operations, should be shown in this form. A bound volume of forms will be maintained for the purpose in the District Forest office. A form with sample entries is given in Appendix X.

289. *Control Journal.*—The history of each coupe shall be written up annually by the District Forest Officer personally. Only information of interest such as suggestions for the future management and improvement of the forest, the results of personal observations regarding the habits and requirements of important species of trees, and the time of flowering and seeding of various species, etc., shall be recorded. The revenue and expenditure under the various working plan prescriptions for the working circle area will also be recorded. It is also desirable that statistics of unsoundness for the various species be collected. Abstracts of Form 3 showing the number of trees and the net yield of timber obtained and the percentage of unsound trees in each girth class, shall be prepared annually and filed with the Control Journal for the working circle. Suitable headings suggested for the Control Journal are given in Appendix XI.

290. *Regeneration ledger.*—All items of expenditure incurred in the regeneration and tending of crops shall be entered annually for each coupe of the working circle. A form with sample entries is given in Appendix XII.

291. *Control maps.*—The working circle maps on a scale of 4 inches to 1 mile show the annual coupes. In these maps the worked coupes are to be accurately posted up to date by means of red hatched lines showing the area actually exploited.

In addition coupe maps on a scale of 16 inches to 1 mile shall be prepared showing—

(*a*) the approximate position of each gap :—○

(*b*) gaps artificially regenerated :—⊖

(*c*) gaps where charcoal burning was permitted :—⦶

(*d*) area over which natural regeneration was tended :—▨

The symbols suggested above may conveniently be used. This map will be filed with the Control Journal.

CHAPTER III.—WORKING PLAN FOR THE TIMBER *CUM* FUEL WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

292. *Area.*—The area of the working circle is 20,550 acres and it is distributed over all four ranges of the division.

293. *Constitution.*—It includes all the former 'coppice with standard' felling series which are considered capable of producing small timber on an economic rotation.

294. *Character of the vegetation.*—The working circle includes all the best deciduous forest areas of the division, where both rainfall and soil conditions are propitious for the development of the predominant species, teak, to small timber dimensions on an economic rotation. The principal congeners of teak, are *Pterocarpus marsupium*, *Anogeissus latifolia*, *Grewia sp.*, *Bauhinia sp.*, *Albizzia sp.* and *Dalbergia latifolia*. In localities where

the rainfall is heavy, for example, the Kuttalam Felling Series, an admixture of evergreens such as *Eugenia sp.*, *Diospyros sp.* and *Aglaia sp.* comes in. In other localities, e.g., parts of the Kalakad, Padaramalai and Koilteri Felling Series, the combined effect of short rotations and recurrent fires have resulted in such a deterioration of the soil that only stunted teak of small dimensions is produced. Again owing to the fact that at the time of reservation patches of abandoned cultivation were absorbed in the reserve, such patches are now to be met with, especially in Puliangudi Felling Series, carrying a growth of grass, *Acacia latronum* and *Dichrostachys cinerea* principally.

SECTION 2.—DIVISION OF THE AREA.

295. *Felling series.*—The working circle has been divided into six felling series as follows :—

Name of range.	Number of felling series.	Name of felling series.	Area.
			ACS.
Srivilliputtur ...	1	Ayyanarkoil	4,800·0
Kuttalam ...	2	Puliangudi	2,800·0
	3	Kuttalam	2,000·0
Ambasamudram	4	Koilteri	3,000·0
	5	Padaramalai	3,950·0
Nanguneri ...	6	Kalakad	4,000·0
		Total ...	20,550·0

The division into felling series has been dictated by the necessity for following the existing divisions as far as possible in order to avoid the felling of immature crops, and in order that the various markets in the division may have their requirements more cheaply met with, and the available staff and labour supply more fully utilized.

SECTION 3.—ANALYSIS AND VALUATION OF THE CROP.

296. *Valuation of the crop.*—Practically all the felling series of the working circle consists of a series of age gradations from one year to a maximum of 30 years, worked in the past under a system of ' coppice with standards '. The forest contains a large variety of species of which teak, *Pterocarpus marsupium*, *Dalbergia latifolia* and *Albizzia lebbek* are valuable as timber, the remaining species being used mainly as fuel. The lack of homogeneity in the growing stock and the varying rate of the growth of each species according to the nature of the soil and the rainfall render the task of accurately estimating the average yield per acre at maturity highly problematical. Again the system of utilization being through the agency of contractors, factors influencing prices, such as the degree of competition, the price of fuel and small timber in relation to commodity prices, and the costs of extraction could not be forecasted with any degree of certainty. Moreover since Government do not know, and are unlikely in the near future, to hold the monopoly of supply of fuel and small timber and hence cannot control the prices of these products; the regulation of the volume yield by the method of exploiting reduced areas was considered to be unjustified in view of the expense involved and the comparatively low price per acre fetched by the standing crop. For these reasons detailed enumeration or valuation surveys were not made.

SECTION 4.—METHOD OF TREATMENT.

297. *Silvicultural system.*—The forest will be worked under the system of ' simple coppice ', natural coppice regeneration being supplemented on a modest scale by artificial means.

298. *Rotation.*—Apart from financial consideration a long rotation is advisable for the following reasons :—

(1) To get a large proportion of the teak to attain small timber yielding size, i.e., 25 inches girth and above;

(2) to let the rest of the crop attain to an average girth of 30 inches;

(3) to extend as long as is possible the intervals between successive clear fellings which in the dry climate and the generally poor soils prevalent in the division have a manifestly deleterious effect;

(4) to allow natural seedling growth and artificial regeneration (prescribed later) to attain exploitable size or at least some degree of maturity before felling; and

(5) to permit of conversion into high forest of such of our present fuel series as are capable of producing timber, in case the industrial demand for fuel decreases in consequences of the development of further schemes of electrification.

On the other hand too long a rotation would reduce the area annually felled besides impairing the coppicing powers of the stools. To ensure the production of vigorous coppice shoots, it is considered necessary to fell trees at an age not exceeding 40 years.

The results of stem analysis, vide paragraph 240, also show that, from a statistical point of view, a rotation of 40 years should result in a satisfactory proportion of the teak crop attaining small timber dimensions.

This rotation is also suitable for the other important species that occur, and is accordingly prescribed.

The Karupasamikoil and Vasudevanallur Felling Series of the Fuel Working Circle, although predominantly teak areas have not been included in this working circle, as it is considered that owing to the precarious rainfall and comparatively poor soil prevalent over the major portion of these series it would be uneconomic to adopt a rotation of more than 30 years. The latter arguments also apply to portions of the Kalakad and Koilteri Felling Series included in this working circle, but in view of the fact that these felling series have been worked in the past on extremely short rotations with the result that much soil deterioration has resulted, it is considered necessary to work them in future on as long a rotation as possible, in order to allow the soil to recuperate naturally.

299. *Regulation of the yield.*—The yield is regulated by area. In each felling series therefore the size of the annual coupe is obtained by dividing the total area by the period of the rotation. Owing to the fact that during the previous rotation the working of coupes has been unmethodical, the necessity for exploiting the oldest age classes first has resulted in slight alterations in the sizes of the annual coupe from year to year, and also in a distribution of the annual coupes in a manner which at first sight may appear capricious. No other alternative was possible however, without serious sacrifice of increment by the felling of immature crops. In the laying out of the annual coupe natural features have been followed as far as possible both with a view to facilitate extraction and to make demarcation less difficult and expensive.

SECTION 5.—METHOD OF EXECUTING FELLINGS.

300. *The annual coupe.*—The principal reasons for the unsaleability of a coupe in the past have been that—

(1) the coupe was too large to be conveniently worked in a year and so extensions of voidah had to be given to contractors to enable them to complete the work. This naturally resulted in bidders fighting shy of taking an adjacent coupe in the same felling series; and

(2) the coupe was too small to make it worthwhile for the contractor to spend money on making short lengths of cart-track to facilitate extraction, with the result that the majority of the produce had to be removed slowly on head-load permits.

The working plan has attempted to remedy these defects by reducing or increasing the size of the annual coupe, the minimum size being 50 acres and the maximum 130 acres. All coupes or portions of coupes, which have been found unworkable have been deleted from each felling series area, if inspection disclosed that such a step was justified. Since no difficulty is likely to be experienced in the disposal of the coupes now prescribed the working plan will indicate both the sequence of coupes and the year of working.

301. *Laying out of the annual coupe.*—The annual coupe will be demarcated on the ground in accordance with the felling series map, by cut lines 10 feet wide except where the boundary is already well defined, as by a road, stream or river. Any new cut lines will be included in the area of the coupe and the lessee of the coupe will be entitled to the produce obtained by cutting such lines. Its correct area will be computed on the basis of actual survey which must be done by an officer not below the grade of Range Officer, who will certify to the correctness of the survey. The necessity for the District Forest Officer checking coupe surveys is emphasized, as inaccurate surveys may involve loss of revenue to the department. It is suggested that some 25 per cent of such surveys should be checked by the District Forest Officer or his gazetted assistant, and the fact recorded with the sale papers concerned.

Unless a departure from the boundaries of the coupe as laid down in the felling series map is involved, on account of unforeseen difficulties on the ground, or the possibility of increasing the area of the coupe by working a suitable adjacent bit of forest at present excluded from the felling series, the difference between the nominal area and the actual area will not constitute a deviation requiring sanction.

302. *Division into strips.*—Each coupe will be divided into not less than three strips, by cut lines 6 feet wide running across the contours. In cases where the greater length of a coupe runs across the contours this rule may be relaxed, and the strip lines made to run along the contours, if considerable economy in the cutting of strip lines results thereby. In such a case the most elevated strip should be worked first. All annual coupe surveys will be completed by Range Officers and submitted to the District Forest Officer by the end of September.

303. *Indicator areas.*—The object of felling indicator areas is twofold :—

(*a*) To enable the District Forest Officer to arrive at an estimate of the net value of the growing stock in a coupe before it is put up for sale.

(*b*) To control the accuracy of the lessees' yield returns.

For the first purpose it is not essential that indicator areas should be felled in every coupe prior to its sale, as fairly accurate ocular estimates of the average outturn per acre can be arrived at by a comparison of the standing crop with that on recently felled adjacent areas, the average outturn per acre of which is available. This method has the additional advantage that departmental expenditure on the felling of indicator areas is avoided. Having estimated the average outturn per acre it is necessary to find out the cost of production per acre, that is, the cost of felling, conversion and transport of the saleable material to the consuming centres, allowing for contractors overhead charges and legitimate profits. From the prevailing market rates for the various conversion units, at the consuming centres an estimate of the net value of the growing stock per acre can be arrived at.

It is therefore prescribed that indicator areas will not be felled *departmentally prior* to sales, but that the net value of the growing stock in every coupe will be estimated by the Range Officer as detailed above; the latter will submit a detailed report on the subject to the District Forest Officer well in advance of the annual sales. The District Forest Officer will satisfy himself that the data on which these estimates are based are accurate.

With the object of controlling the accuracy of the lessees' yield return and also obtaining reliable data on which to base future estimates of yield from adjacent coupes, it is further prescribed that during the demarcation and survey of a coupe, the Range Officer will select and demarcate by 6 feet wide lines, an indicator area not exceeding 1 acre in extent individually, in each strip of the coupe in a locality which is sufficiently representative of the growing stock in that strip. The lessee will be required by a clause in his agreement, to fell and stack all saleable material on this area, before he commences felling in the rest of the strip, and to notify the Ranger in writing as soon as this operation has been completed. The latter will measure up the stacked fuel and converted timber in stacked cubic feet and cubic feet, respectively, with the minimum of delay, and will report the yield obtained forthwith to the District Forest Officer for record in the Control Book. The District Forest Officer with the previous approval of the Territorial Conservator, will however be permitted to dispense with the laying out of indicator areas as detailed above, in any coupe, in case he is satisfied that the growing stock in such a coupe is similar to that which was present in a previously felled adjacent coupe for which accurate yield data are available.

304. *Agency of felling.*—The fellings should continue to be conducted through the agency of contractors, as departmental extraction in the past has proved less remunerative. The coupes will be put up for sale in public auction early in December, so as to provide time for the disposal of the coupe by tender if the prices obtained at the sale are unsatisfactory. The present system of selling coupes in the respective Range headquarters, instead of at the District Forest Officer's headquarters, has been amply justified by results and should, it is suggested, be continued.

The coupe will be conveyed to the lessee on the 1st April, a voidah of 12 months being allowed. Coupes unsold in time or leased subsequently on tender, should not ordinarily have an extension of voidah beyond the 31st of the following March, as extensions of voidah interfere with regeneration operations which are of the greatest importance. Range Officers should ensure by frequent inspections that the work of felling and removal is being effected at such a rate, that these operations will be complete by the end of the period of the contract. In exceptional circumstances, if extension of voidah is essential, the District Forest Officer will address the Conservator on the matter who will allow it if he considers it advisable.

305. *Coupe arrears.*—Any portion of the annual coupe left unworked by the contractor after the termination of the period of his contract, will be surveyed by the Range Officer and its area computed. The District Forest Officer will put up the arrear area for sale

as soon as possible after it has been surveyed, allowing such voidah as he considers necessary to enable the contractor to fell and remove the produce on it. In case however the District Forest Officer is satisfied that the portion contains very poor growth, or that it is inexpedient to clear fell it, or that it is difficult or unremunerative to work it he may depart from this rule, and the area may then remain unfelled. Full reasons for such a step will be recorded in the Control Book.

306. *Reserved species.*—All sandal, *Terminalia chebula*, tamarind, bamboo, palmyra and *Bombax malabaricum* occurring in the annual coupe shall be reserved. The retention of these species is prescribed, because, they are not regular fuel yielding species and their value as timber or minor forest produce yielding trees is much greater than their fuel value. The District Forest Officer may after inspection authorize the felling of aged, crooked or otherwise unsound trees of reserved species except sandal, but power to this must be explicitly reserved in any minor forest produce lease that may be affected. In the case of tamarind trees so felled root wounding around the stump will be done by the contractor as it has been found experimentally that such treatment usually yields a crop of root suckers. Other species may be added to the list by the District Forest Officer subject to the approval of the Territorial Conservator, but the number should be limited as far as possible so as to avoid unnecessary interference with the contractor.

307. *Felling rules.*—(1) Felling should proceed strip by strip and the strips should be arranged whenever possible so that arrears can if they occur be conveniently added to the succeeding year's coupe.

(2) All trees of the following species shall be cut by the lessee at a height of not less than 2 feet from ground level and the bark all round the stump shall be peeled off with a view to killing the stump, as these species are useless as fuel or timber :—

(*a*) *Gyrocarpus jacquini.*
(*b*) *Cochlospermum gossypium.*
(*c*) *Dalbergia paniculata.*

(3) *Euphorbia tirucalli* shall be cut at ground level but shall not be coppiced.

(4) All strobilanthes in the annual coupe will be cut at ground level below the prop or stilt roots, heaped in patches over the area and burnt by the lessee. The eradication of this weed is a matter of the first importance and the result of annual operations should invariably be recorded in the Control Journal.

(5) Lantana wherever it occurs in the annual coupe shall be uprooted by the lessee.

308. *Coppicing.*—It is not necessary to insist on any elaborate or particular method of trimming the stool. All that is required is that the cut be close to the ground and the bark be not separated from the wood. A sloping cut with one side at ground level and the other not more than 6 inches above it, is perhaps the best. The use of sharp axes and bill-hooks should be insisted upon by frequent inspection.

The Range Officer must ensure that no coppicing or trimming of stools takes place at any appreciable interval after felling. Cut stools should never be retrimmed except under the personal orders of the District Forest Officer or a superior officer. The practice of redressing stools before impending visits of superior officers must on no account be allowed.

309. *Disposal of felled material.*—All felling shall be done by the contractor's coolies and the contractor or his duly authorized agent shall be present in the coupe whenever felling or removals are in progress. All fuel billets not removable on head-load permits should, it is suggested, be stacked in stacks of uniform measurements. The local units vary according to locality and it is desirable to introduce some uniformity, without at the same time causing unnecessary annoyance to the contractor. It is recommended that a stack measuring 5 feet by 4 feet by 2½ feet (50 stacked cubic feet) be adopted. Removals of fuel below 6 inches girth on head-load permits will be permitted without prior stacking subject to the restriction in paragraph 314 below; but such permits will be issued only inside the coupe itself. All timber shall, on felling and conversion, be hammermarked by the local beat guard before removal, and he will submit in his weekly diary an account of such timber classified according to species in units. A monthly abstract of the guard's accounts shall be prepared in the Range Office and submitted to the District Forest Officer by the first of the succeeding month. In accordance with Chief Conservator's Proceedings Miscellaneous No. 364, dated 15th August 1933, it is suggested that arrangements be made to limit the number of head-load permits that the contractor may issue, due regard being paid firstly to the possibility of the coupe and secondly to the department's requirements in the way of suitable material for burning on rab patches.

SECTION 6.—TABULAR STATEMENT OF FELLINGS.

310. *Statement of fellings.*—The following table gives the sequence of fellings, the year of working and the nominal area of the annual coupe in each felling series :—

Year of working.	Coupe number.	Ayyanar-koil.	Pulian-gudi.	Kutta-lam.	Koil-teri.	Padara-malai.	Kala-kad.
		ACS.	ACS.	ACS.	ACS.	ACS.	ACS.
1934–35	I	120·0	104·0	50·0	80·0	100·0	107·0
1935–36	II	120·0	70·0	50·0	87·0	101·0	105·0
1936–37	III	132·0	70·0	50·0	84·0	102·0	93·0
1937–38	IV	125·0	70·0	50·0	71·0	101·0	108·0
1938–39	V	120·0	70·0	50·0	76·0	100·0	95·0
1939–40	VI	132·0	70·0	50·0	76·0	103·0	108·0
1940–41	VII	120·0	70·0	50·0	80·0	100·0	104·0
1941–42	VIII	100·0	70·0	50·0	73·0	100·0	100·0
1942–43	IX	120·0	70·0	50·0	83·0	101·0	100·0
1943–44	X	128·0	70·0	50·0	78·0	100·0	106·0
	Total ...	1,217·0	734·0	500·0	788·0	1,008·0	1,026·0

Grand total = 5,273

SECTION 7.—SUBSIDIARY REGULATIONS.

311. *Artificial regeneration.*—The low density of stocking prevalent in portions of the annual coupes of most of the felling series, the failure of a proportion of the oldest stumps under the old 'coppice with standard' system to send up coppice shoots, and the suppression of young teak coppice by strobilanthes, all point to the necessity of artificial regeneration to supplement coppice regrowth where necessary. The crux of the problem is to devise a system which is reasonably certain of success and at the same time financially justifiable. The mistake made in the past was, that either too much or nothing in this direction was attempted. It is therefore essential to limit artificial regeneration to such areas as stand most in need of it, so that adequate supervision by the District Forest Officer, which is the prime essential to success, can be ensured.

312. *Choice of species.*—Teak will be the principal species chosen for artificial regeneration in all the felling series where its natural regeneration from coppice or seedling growth is deficient.

But where, as a result of recurrent fires in the past, large patches of the forest are covered with almost pure teak, which is stunted and therefore incapable of producing small timber on an economic rotation, other species will be selected for artificial regeneration. Further as teak is leafless during the major portion of the hot weather much soil exposure, and consequent deterioration, results in pure teak forest in comparatively dry areas such as are those now under contemplation. In such areas it will be necessary to introduce mixture with teak of species which are either leafless for comparatively short periods, or evergreen, with a view to increase the value of the forest and protect and improve the soil. Species suggested for introduction are, in the order of importance, *Dalbergia sissoides* or *latifolia, Pterocarpus marsupium, Swietenia mahogani, Chloroxylon swietenia, Albizzia lebbek* and *odoratissima, Azadirachta indica,* and *Tamarindus indicus.*

The District Forest Officer is at liberty to add to this list, and should consult the Provincial Silviculturist in this important matter from time to time.

313. *Rab sowings.*—The conversion of vegetable matter into ashes by burning, and the mixing of the resulting ash with the soil prior to sowing of seeds, in order to enrich the mineral content of the soil, is a well-known practice in agriculture. This operation, as applied to forestry, and known as 'rab sowing' has met with varying degrees of success in the forests of the Presidency. One of the advantages of the method is that the burning has the salutary effect of freeing the tree crop from weed competition for a year or more, and another is that the resulting ash enriches the soil. For success it is necessary to ensure—

(*a*) that a windless day is selected for safe burning and raking up of the ashes with the soil;

(*b*) that the area selected has no more than a moderate slope, so that the mixture of ash and soil may be retained and not be washed away by rain ; and

(*c*) that there is sufficient slash to provide a good burn.

With the exception of the Padaramalai and Koilteri Felling Series, the others are situated mostly on rather steep slopes. Further, utilization of fuel is so complete on account of the keen demand that it would cause great hardship to a large number of labourers if removals of fuel on head-loads from the annual coupes were greatly restricted in order to provide sufficient material for 'rab' burning, over the whole of the annual coupe.

314. *Method of regeneration.*—The following method has therefore been devised with a view to overcome the difficulties peculiar to the division, and to ensure that supervision is effective :—

At the time of survey of the annual coupe in all the felling series except Kuttalam and Ayyanarkoil, the Range Officer will select blocks of forest suitable for regeneration, in each strip where the stocking of teak is below 25 per cent or where the density of stocking of timber species is below 50 per cent. Each such block should not be less than 3 acres in extent, and have as far as possible a regular shape, i.e., be bounded by straight lines. The total area covered by such blocks should not exceed 25 per cent of the area of the annual coupe; this limit has been imposed as the method of artificial regeneration prescribed is still in the experimental stage, and until a successful technique has been developed large-scale operations would be injudicious.

Parts of the forest that are obviously unsuited to the growth of tree species, such as often are natural blanks in the forest, shall on no account be taken up for artificial regeneration. All the blocks selected will be surveyed and demarcated by a cleared line 6 feet wide and rough stone cairns at suitable intervals; they will also be marked on a map of the coupe on a scale of 16 inches to 1 mile. The District Forest Officer shall inspect the areas selected and alter them if necessary prior to their demarcation and survey; on the areas ultimately approved of, the District Forest Officer shall, by a clause in the contractor's agreement, reserve to himself the power of requiring him to stack all slash below 3 inches in girth, in broken lines, at suitable intervals (1 chain apart is suggested), running along the contours. Such stacks shall be about 4 feet wide and about 4 feet high and care shall be taken that the material is not stacked within 2 feet of the stool of any good fuel or timber species. All such heaping of slash in a particular strip should be completed before the contractor is permitted to fell the succeeding strip.

In August-September, the rabs on the area over which felling and removals have been completed by the contractor, will be burnt departmentally on a windless day, care being taken to ensure that a good burn is secured. The resulting ash will as soon as possible be raked up with the soil, and shallow broken trenches, 6 inches deep and a foot wide, shall be dug along the centre of the lines, and the mixture of soil and ashes put back into the trench where the area is comparatively flat, and heaped on the hill side of the trench where the area is sloping, so as to minimize wash. Seeds of timber species such as teak, *Dalbergia latifolia* and *sissoides*, *Pterocarpus marsupium*, *Chloroxylon swietenia*, *Swietenia mahogani*, *Albizzia lebbek*, *Azadirachta indica*, and *Tamarindus indicus*, will be sown on the ridges formed as above. In places obviously unsuited for any particular species, it will, of course, not be introduced artificially. Where the stocking of teak is defective this species will be introduced by stump planting in addition to the sowing advocated above, at an espacement of 12 feet along the lines some fortnight or so before the north-east monsoon is expected to break. The introduction of *Dalbergia sissoides* and *latifolia* by stump planting is also recommended. This will be effected by planting stumps of these species in between the teak stumps.

Where the stocking of teak is good but the species itself is stunted, it is recommended that in addition to the other timber species mentioned above, the following evergreen species be introduced by dibbling in suitable localities in order to protect and improve the soil, a matter of considerable importance in a dry district like Tinnevelly :—

(1) *Schleichera trijuga.*

(2) *Calophyllum inophyllum.*

(3) *Pongamia glabra.*

(4) *Artocarpus integrifolia.*

(5) *Mangifera indica.*

In the succeeding April, the blocks to be regenerated in the remaining portions of the previous year's annual coupe will be treated similarly. It is suggested that in Puliangudi Felling Series the strips be so arranged that a greater portion of the regeneration work to be done, is effected in August-September, as the south-west monsoon in this locality is irregular and comparatively scanty.

315. *Teak plantations.*—With the exception of coupes III and IV of the Kuttalam Felling Series the remaining coupes of the working plan period, in this felling series although well-stocked are characterized by the absence of teak. The rainfall and soil conditions prevailing in these areas are both propitious for the development of teak to small timber dimensions. In addition the felling series is favourably situated from the point of view of extraction and markets. The two 10-acre teak ponam plantations raised during 1932–33 and 1933–34, respectively, prove that this species can be cheaply and successfully raised in this locality. The raising of field crops in conjunction with tree crops however cannot but result in some reduction of the productive capacity of the soil. Again in order to raise the field crops required, the whole area has to be dug up twice a year, and such a procedure, on the sloping ground and with the comparatively high rainfall prevalent in this felling series, probably results in a proportion of the valuable surface soil being washed away. It must be realized that the growth in these coupes is sold standing to a contractor who is required to fell the area and hand it over, after burning unsaleable material, in a state fit for planting; all that the ponamdar saves us is the cost of staking, stump planting and weeding, and even to do this he has to be constantly goaded by the local subordinates. Finally it may be ultimately discovered that the savings effected in the cost of formation of such plantations may be largely illusory, the final crop obtained being proportionately inferior to a crop raised under similar conditions without the assistance of a ponamdar. Under these circumstances it would be unwise to increase the area to be planted thus annually. It has been advocated that a belt of forest 100 acres in extent be excluded from the felling series and reserved for planting up during the period of the working plan. This has the disadvantage that it is not possible to find such a block *all* of which would be suitable both for raising teak and field crops; secondly such a reservation would result in undue distortion of the boundaries of the coupes to be felled during the period of the plan, and consequently increase the expense of demarcation and the difficulties of extraction.

316. *Method of treatment.*—It is accordingly prescribed that at the time of survey of the annual coupe in the Kuttalam Felling Series, the Range Officer will select within the coupe a compact area of not more than 10 acres in extent with a rectangular or square shape, all of which will be suitable for planting with teak. The block selected will be approved of or altered, as the case may be, by the District Forest Officer after inspection. The block ultimately approved of, will be demarcated by cut lines 6 feet wide and rough stone cairns at suitable intervals along the lines. The annual coupe will be sold in public auction but the District Forest Officer will reserve to himself by a clause in the contract agreement the power to constrain the contractor :—

(*a*) to reserve all slash below 6 inches in girth on the area to be planted so as to provide sufficient material for a good burn,

(*b*) to fell the area to be planted, immediately after the north-east monsoon so that the expense of cutting back coppice regrowth may be reduced to a minimum, and the slash reserved may be in a suitable condition for burning, and

(*c*) to burn the area completely and hand it over to the department by the 31st of March in a condition fit for planting.

The ponamdar will be permitted to enter the area on the 1st of the succeeding April and will stake it at an espacement of 6′ × 6′, with stakes 3 feet in length, obtained from shrub species only, in the adjacent forests. No tree growth will be felled for the purpose. The staking will be completed as early in April as possible. As soon as the first showers in April or May render the ground soft enough for stump planting, the ponamdar will be provided with a sufficient number of teak stumps departmentally, and will plant up the whole area with the minimum loss of time under departmental supervision. If it is found possible to plant the stumps at the beginning of April, even before the first showers, this will be done, as it has been shown by the Provincial Silviculturist that early planting results in a very marked increase in growth in the first year. He should be consulted on this point. Seeds of *Dalbergia latifolia* or *Pterocarpus marsupium* will be sown at each stake simultaneously with stump-planting operations, with a view to obtaining a suitable admixture in the crop. Small patches obviously unsuitable for teak will be planted up with rosewood stumps instead.

The ponamdar will be permitted to grow ragi, gram, chillies and similar crops which do not grow to a height of more than 2 feet. The raising of gingelly and vegetable creeper crops of any kind will be prohibited, as the former is extremely exhausting to the soil and the latter make effective weeding impracticable. He will keep the tree crop adequately weeded, all seedlings being kept clear of weeds to a radius of 1 foot around

them. He will also replace all casualties with teak or rosewood stump plants provided departmentally as occasion arises, so that a fully stocked plantation is handed over to the department on the 31st of the succeeding March.

317. *Second year weeding.*—One weeding and soil aeration will be done departmentally just before the south-west monsoon. A second weeding if necessary will be done in the same year before the north-east monsoon.

318. *The Walayar method.*—Subject to the provisos that the stocking of teak in the area selected is below 25 per cent of the crop, and the soil is suitable for this species, *up to* 25 per cent of the area of the annual coupe in the Kuttalam and Ayyanarkoil Felling Series will be regenerated artificially with teak in the year after felling by a modification of the Walayar method.

At the time of survey of the annual coupe, the area to be so regenerated will be selected by the Range Officer in accordance with the above regulations and approved of by the District Forest Officer. The blocks selected should be not less than 3 acres in extent and should have as far as possible a regular shape. After they have been approved of by the District Forest Officer they will be surveyed and demarcated in a suitable manner, and marked on a map of the coupe on a scale of 16 inches to 1 mile. It is suggested that most of the area to be regenerated be included in the final strip so that the time between exploitation and regeneration is reduced to a minimum.

All existing slash will be burnt early in April and the area staked immediately thereafter at an espacement of 12′ × 12′. A closer espacement is not advocated as the expense would be greater than is warranted the prescription being in the nature of an experiment which future experience alone will justify. The area will be planted up with about one year old teak stumps as soon as the first showers in April-May have made the ground soft enough for planting.

The Provincial Sylviculturist should be consulted as to the latest results obtained in regard to early stump-planting. A mixture of species is desirable and is to be encouraged by preserving other timber species such as *Pterocarpus marsupium*, *Dalbergia latifolia*, *Chloroxylon swietenia*, which appear naturally.

On the basis that not more than 25 per cent of the annual coupe in each of the abovementioned felling series will be regenerated under this system, it is estimated that 12 acres in the Kuttalam Felling Series and 30 acres in the Ayyanarkoil Felling Series will be so regenerated annually.

On the banks of the Ammankoil and Rajamparai rivers, lying just outside, and west of, the Ayyanarkoil Felling Series, is a fringe of semi-deciduous growth varying in width from 2 to 5 chains. In the surrounding forest there is a quantity of fairly good teak. With a view to increasing the future value of these forests the conversion of suitable portions of this fringe to teak plantations would appear to be a profitable proposition.

If the teak planting prescribed above, in the Ayyanarkoil Series, prove successful steps should be taken to extend the planting to these areas.

319. *Nursery.*—The following table shows the number of teak stumps that will be required annually for the various operations prescribed above, an extra allowance of 25 per cent being made for replacement of casualties.

Name of felling series.	Operation.	Area.	Espacement.	Number of stumps per acre.	Total number of stumps.
		ACS.			
Kuttalam	1 Plantation	10	6′ × 6′	1,500	15,000
	2 Walayar method	12	12′ × 12′	375	4,500
Ayyanarkoil	1 Do.	30	12′ × 12′	375	11,250
				Total ..	30,750

The required number of stumps will be raised at Kuttalam in the Rest-house compound. Here a really good permanent nursery will be made on scientific lines, under constant supervision and stumps sent out to regeneration areas where they are wanted. Details of teak nursery practice are given in paragraphs 400–410 under the Clear Felling Working Circle.

320. *Seed collection.*—The collection of good seed at the appropriate season and its careful storage are matters of the greatest importance, the progress of which should be carefully watched by the District Forest Officer. Attention is invited to Appendix II, where particulars as to the time of seeding of the various species are given.

321. *Replacing of casualties.*—In the areas sown before the north-east monsoon casualties will be replaced by sowing before the succeeding south-west monsoon, and areas sown before the latter monsoon will be resown where necessary before the succeeding north-east monsoon. In the Kuttalam and Ayyanarkoil Felling Series, casualties in the area treated under the Walayar method, will be replaced by stumps immediately before the succeeding north-east monsoon.

322. *Weeding.*—Weeding of the seed lines in the rab-sown area will probably be necessary in the second year. The problem will be dealt with by the District Forest Officer when it arises.

In the area in the Kuttalam and Ayyanarkoil Felling Series treated under the Walayar method, weeding including soil aeration for a radius of one foot around each stump-plant will be done in the year of planting just before the north-east monsoon that is by about the 15th October.

A second weeding will be completed by the 15th of the succeeding May. Weedings *immediately after* the monsoons are not advocated as the resulting exposure of the seedlings to the hot and dry winds prevailing during the interregnum between the monsoons have been found to increase casualties appreciably.

323. *Climber cutting.*—Climber cutting operations periodically over the whole of the working circle on a regular scheme have been advocated. There is little doubt that such operations would be beneficial in areas, where, owing to a comparatively high rainfall, climber growth is particularly luxuriant and consequently suppression of coppice and seedling regrowth likely. Whether the cost of such operations could be recouped by the increased growth induced, is open to serious doubt. It is accordingly prescribed that climber cutting will be done departmentally only in the first three coupes of the Padaramalai and Kuttalam Felling Series in the second and fifth year after felling. The results with costs, will be recorded in the Control Journal, and a decision as to whether the operation should be discontinued or extended to the coupes of the remaining felling series arrived at in the eighth year of the working plan period, by the District Forest Officer with the approval of the Territorial Conservator.

324. *Thinning.*—In the fifth year after formation the areas in the Kuttalam and Ayyanarkoil Felling Series treated under the Walayar method will be examined by the District Forest Officer with a view to ascertaining whether a thinning would be necessary in the interests of preserving the teak crop from suppression by faster growing coppice of other species. If this is found necessary it will be done under the personal supervision of the District Forest Officer or his gazetted assistant.

In this operation a promising teak pole will be favoured against any other species; a poor teak pole will be cut out in favour of a promising pole of any other timber species. It is anticipated that the cost of this operation will be more than made up by the sale of the felled material.

For purposes of future treatment the 10-acre teak plantations prescribed in the Kuttalam Felling Series have been included under Clear Felling Working Circle.

325. *Tabular statement of regeneration operations.*—The following table shows at a glance the regeneration operations to be conducted in each felling series annually. For convenience of representation, the felling series have been numbered serially with Roman numerals. It has also been presumed in the case of rab sowings, that 50 per cent of the area to be regenerated in the annual coupe will be regenerated in the year of felling, and the balance in the succeeding year. This presumption has been made solely for the purpose of arriving at a rough estimate of the area to be regenerated annually, and is not meant to restrict the conduct of such operations by the District Forest Officer in any way :—

Year of operation.	Serial number of felling series.	Teak plantation.		Walayar system.		Rab sowing.	
		Coupe number.	Maximum area.	Coupe number.	Maximum area.	Coupe number.	Maximum area.
			ACS.		ACS.		ACS.
1934–35	I	..	..	..	..	....	..
	II	..	..	..	..	1 (part) ..	13
	III	1	10	..	..	....	..
	IV	..	..	..	..	1 (part) ..	10
	V	..	..	..	..	1 (part) ..	13
	VI	..	..	..	..	1 (part) ..	13
1935–36	I	..	..	1	30	....	..
	II	..	..	..	..	1 and 2 (part) ..	22
	III	1	10	1	12	....	..
	IV	..	..	..	..	1 and 2 (part) ..	21
	V	..	..	..	..	1 and 2 (part) ..	25
	VI	..	..	..	..	1 and 2 (part) ..	26

Year of operation.	Serial number of felling series.	Teak plantation.		Walayar system.		Rab sowing.	
		Coupe number.	Maximum area.	Coupe number.	Maximum area.	Coupe number.	Maximum area.
			ACS.		ACS.		ACS.
1936-37	I	..	..	2	30	....	..
	II	..	..	..	..	2 and 3 (part) ..	18
	III	2	10	2	12	....	..
	IV	..	..	..	..	2 and 3 (part) ..	21
	V	..	..	..	..	2 and 3 (part) ..	25
	VI	..	..	..	..	2 and 3 (part) ..	25
1937-38	I	..	..	3	33	....	..
	II	..	..	..	..	3 and 4 (part) ..	17
	III	3	10	3	12	....	..
	IV	..	..	..	..	3 and 4 (part) ..	19
	V	..	..	..	..	3 and 4 (part) ..	25
	VI	..	..	..	..	3 and 4 (part) ..	25
1938-39	I	..	..	4	31	....	..
	II	..	..	..	..	4 and 5 (part) ..	18
	III	4	10	4	12	....	..
	IV	..	..	..	..	4 and 5 (part) ..	18
	V	..	..	..	..	4 and 5 (part) ..	25
	VI	..	..	..	..	4 and 5 (part) ..	26
1939-40	I	..	..	5	30	....	..
	II	..	..	..	..	5 and 6 (part) ..	18
	III	5	10	5	12	....	..
	IV	..	..	..	..	5 and 6 (part) ..	19
	V	..	..	..	..	5 and 6 (part) ..	25
	VI	..	..	..	..	5 and 6 (part) ..	26
1940-41	I	..	..	6	30	....	..
	II	..	..	..	..	6 and 7 (part) ..	17
	III	6	10	6	12	....	..
	IV	..	..	..	..	6 and 7 (part) ..	19
	V	..	..	..	..	6 and 7 (part) ..	25
	VI	..	..	..	..	6 and 7 (part) ..	26
1941-42	I	..	..	7	30	....	..
	II	..	..	..	..	7 and 8 (part) ..	18
	III	7	10	7	12	....	..
	IV	..	..	..	..	7 and 8 (part) ..	19
	V	..	..	..	..	7 and 8 (part) ..	25
	VI	..	..	..	..	7 and 8 (part) ..	26
1942-43	I	..	..	8	30	....	..
	II	..	..	..	..	8 and 9 (part) ..	17
	III	8	10	8	12	....	..
	IV	..	..	..	..	8 and 9 (part) ..	19
	V	..	..	..	..	8 and 9 (part) ..	25
	VI	..	..	..	..	8 and 9 (part) ..	26
1943-44	I	..	..	9	30	....	..
	II	..	..	..	..	9 and 10 (part) ..	18
	III	9	10	9	12	....	..
	IV	..	..	..	..	9 and 10 (part) ..	19
	V	..	..	..	..	9 and 10 (part) ..	25
	VI	..	..	..	..	9 and 10 (part) ..	26

SECTION 8.—OTHER REGULATIONS.

326. *Demarcation.*—Four salient corners of the annual coupe will be demarcated with cut-stone slabs, showing the coupe number, the year of working, as well as the adjacent coupe number and its year of working. For this purpose old coupe stones will be defaced and used wherever possible.

327. *Grazing.*—The evils of grazing have been commented upon in paragraph 84 above. The soil is so trampled by large numbers of cattle, that it is rendered unfit for the reception of seeds of timber trees, with the result that seedling regeneration is deficient. Complete closure of the whole working circle would be ideal but would cause a degree of hardship and resentment, that would be unwise to provoke. It is however absolutely essential that the natural coppice regeneration and the artificial regeneration prescribed, should be protected from cattle until they are out of danger. It is therefore prescribed that all coupes in the various felling series will be closed to grazing for a period of 10 years after felling. In addition the coupe under felling will also be closed to grazing. It is neither necessary nor practicable to provide watering places within the fuel series. The cutting and removal of fodder grass in fuel coupes closed to grazing will be allowed free of charge and should be encouraged.

328. *Fire protection.*—No special measures for fire protection within the working circle are advocated, as past experience has shown that such measures are not justified by the expense involved. The rigid closure of such areas as are burnt after a big fire has occurred is essential to allow of the recovery of the area and must be enforced. To be of effect such closure must follow immediately on the fire. The procedure to be adopted is detailed in paragraph 465, under prescriptions for the Grazing Working Circle.

Where young regeneration areas are burnt the District Forest Officer will after inspection order the cutting back of all damaged regeneration where such a step appears necessary. This work could often be done by the local subordinates themselves free of cost.

329. *Supply of agricultural implements.*—It is not necessary or advisable to constrain contractors to maintain a minimum supply of these implements as, if there is a demand, they are sure to meet it in their own interests. Besides every individual ryot has usually his own idiosyncrasies as to the shape, and the nature of the timber he requires for this purpose, and any manufacture of these implements on a standard pattern is likely to result in loss.

330. *Charcoal burning.*—Charcoal burning will be permitted on request by the contractor in all the annual coupes. Not more than two pits will be permitted on any one acre. The contractor will be required to clear all inflammable material for a radius of 30 feet around each pit, and will be liable to forfeit his security deposit in case his carelessness in this respect causes a fire within the annual coupe.

331. *Illicit fellings.*—The contractor will also be held responsible for all illicit fellings which occur within 10 chains of the boundary of the area leased out to him.

332. *Strobilanthes.*—The District Forest Officer in consultation with the Provincial Sylviculturist will carry out experiments in typical areas swamped by strobilanthes in the Padaramalai Felling Series with a view to discovering a cheap but effective way of eradicating this pest. The results of such experiments with costs will be recorded in the Control Journal.

It is also prescribed that all strobilanthes found in the annual coupe in each felling series be required to be cut by the contractor below the prop or stilt roots, heaped in patches and burnt.

333. *Sambur damage.*—The young teak in portions of Padaramalai and Koilteri Felling Series is subject to bad damage by sambur, which strip the young bark of coppice shoots and break off the tops of leading shoots. In places complete plantations have thus been destroyed. This form of damage usually occurs during the nights of the hot weather and is probably due to the insufficiency of palatable sambur fodder. It is most difficult to prescribe a cure. Probably the best plan will be for the District Forest Officer to organize beats periodically and destroy a proportion of the sambur. Before this is done the District Forest Officer will obtain the Chief Conservator's sanction, addressing him on the subject through the Collector and the Territorial Conservator.

334. *Record of statistics.*—The contractor will be required to furnish monthly statements of removals of fuel and small timber to the Range Officer not later than the 25th of each month, showing the number of stacks or cart-loads of fuel removed, the quantity sold on head-load permits and species and volume of timber extracted in cubic feet. The Range Officer will send a monthly abstract of these accounts for each annual coupe, to the District Forest Officer, so as to reach him by the 1st of the succeeding month. The total removals of fuel and timber during the year will be abstracted in the District Forest office and entered in the appropriate column of the Control Book. The following conversion factors will be adopted :—

26 bags charcoal	.. ..	1 ton charcoal.
1 ton charcoal	.. ..	5 tons fuel.
125 stacked c.ft. fuel	.. ..	1 ton fuel.
50 c.ft. timber	.. ..	1 ton timber.
40 Head loads fuel	.. ..	1 ton fuel.

335. *Control.*—The following Control records will be maintained by the District Forest Officer :—

(*a*) Control Book.
(*b*) Record of Works.
(*c*) Regeneration Ledger.
(*d*) Control Journal for the working circle, and
(*e*) Control Maps.

Control Book.—All operations actually carried out in connexion with exploitation in each felling series will be entered in the appropriate columns. All deviations by whatever authority sanctioned will also be entered with brief reasons in the Control Book. A sample form is given in Appendix XIII.

Record of Works.—All works carried out under the prescriptions or recommendations of the working plan, as well as such measures as are neither prescribed nor suggested but are carried out, will be recorded in this form. A sample form is given in Appendix XIV.

Regeneration Ledger.—The costs and details of all artificial, rab and other regeneration operations will be entered in this form—vide Appendix XVI.

Control Journal.—This record will contain all noteworthy occurrences bearing on the management and improvement of the forest, the unit of area being the working circle. Only observations made in the field on such subjects as the state of reproduction of the more valuable species, the extent to which the methods of treatment prescribed have been suitable, successful, financially justifiable or otherwise, shall be recorded. No information available in other prescribed forms shall be recorded here. The journal will be written up by the District Forest Officer himself or his gazetted assistant. Sample headings are given in Appendix XV but are not intended to be exhaustive.

336. *Control Maps.*—After completion of fellings in each coupe under this plan the area actually worked shall be marked distinctly in light carmine wash with the year of working in the middle of the coupe. In the case of arrear areas, the actual year of working shall be noted in the middle of the arrear area, which shall be distinguished by dotted carmine lines. Where the area actually leased out differs from that prescribed, the actual area shall be marked in dotted black lines. A plan of the annual coupe on a scale of 16 inches to 1 mile, enlarged by the pentagraph or the method of squares, shall show diagramatically the position of the blocks regenerated as well as the lay-out of the rab lines with particulars of the species or mixture of species sown or stump planted.

CHAPTER IV.—WORKING PLAN FOR THE FUEL WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

337. *Area.*—The area of the working circle is 40,630 acres and it is distributed over all the four ranges of the division.

338. *Constitution.*—It includes such of the deciduous and semi-deciduous forests of the division as are capable of producing mainly fuel and incidentally some small timber on an economic rotation. Exploitation has been restricted only to such portions of these forests as contain a sufficiency of growing stock to render extraction remunerative.

339. *Character of the vegetation.*—The following types of vegetation may be recognized :—

(*a*) Where both rainfall and soil conditions are conducive to the development of only the more xerophytic species, *Dalbergia multiflora*, *Dischrostachys cinerea*, *Dolichandrone crispa*, *Zizyphus sp. Randia sp.* and *Acacia leucophlœa* are the principal species to be met with. The undergrowth consists mainly of *Dodonea viscosa*, *Cassia auriculata* and grass. Characteristic examples of this type are the Rengarcoil felling series in Srivilliputtur range, and the Kolundumamalai and Vallanad felling series in Nanguneri range. Here the height growth of the forest is generally below 15 feet and the fuel yield per acre averages 2 to 3 tons. Little, if any small timber can be produced.

(*b*) Where rainfall and soil conditions are more favourable a better type of vegetation results. The principal species are *Albizzia amara* and *lebbek*, *Acacia leucophlœa* and *ferruginea*. *Randia sp.*, *Zizyphus sp.*, the undergrowth consisting mainly of strobilanthes and grass. The Valaikulam felling series in Srivilliputtur range and coupes I to III of Karuppasamikoil felling series are characteristic examples.

(*c*) The bulk of the forest on the outer slopes of the ghats, form the third type which consists of a degraded form of type III described in paragraph 44, Part I, caused mainly by the combined effects of overgrazing and recurrent fires.

(*d*) Patches of semi-deciduous forest containing principally *Aglaia sp.*, *Diospyros sp.*, *Vitex altissima*, *Holoptelea integrifolia*, *Pongamia glabra*, *Pterospermum rubiginosum* and *glabrescens*, *Cordia myxa*, etc., have also been included in some of the felling series of this working circle where it was considered that such patches were too small in extent to be constituted into a separate working circle, and where the factors of locality were not considered conducive to the development of small timber on an economic rotation. Such areas occur in the Sivasalem felling series of Ambasamudram range, and the Tirukurangudi felling series of Nanguneri range.

SECTION 2.—DIVISION OF THE AREA.

340. *Felling Series.*—The working circle has been divided into the following felling series :—

Range.	Serial number of felling series.	Name of felling series.	Area.
Srivilliputtur	1	Unipattimalai	1,628·0
	2	Pudupatti	2,245·0
	3	Rengarkoil	2,019·0
	4	Alagarkoil	2,020·0
	5	Valaikulam	1,518·0
Kuttalam	6	Vasudevanallur	3,000·0
	7	Karuppasamikoil	3,000·0
	8	Kadayanallur	2,100·0
	9	Chinnakadu	1,300·0
	10	Mathalamparai	2,100·0
Ambasamudram	11	Govindaperi	1,320·0
	12	Sivasalem	2,200·0
	13	Ambur	1,950·0
	14	Koriar	1,620·0
Nanguneri	15	Kolundumamalai	1,260·0
	16	Padmaneri	1,650·0
	17	Vadagarai	2,220·0
	18	Malayadipudur	630·0
	19	Nambikoil	1,200·0
	20	Tirukurangudi	1,600·0
	21	Parivarisuriyan	1,350·0
	22	Vallanad	2,700·0

The division into felling series has been dictated by the necessity for following the existing divisions as far as was practicable, in order to avoid the felling of immature crops, and also with a view to meet the requirements of the various markets for fuel in the division as cheaply as possible, and to fully utilize the available staff and labour supply. Again where the nature of the growth in any of the old felling series varied so appreciably as to require a different method of treatment, such felling series were split up wherever possible, and a reallocation of areas to adjacent felling series containing similar growth effected. Thus the portion of the old Kuttalam Felling Series, west of the Chittar, has been combined with the Vadagarai Melpidagai reserve to form a separate felling series under the Timber cum Fuel working circle, and the portion east of the Chittar constituted into the Mathalamparai Felling Series. Similarly the portion of the old Panpuli felling series in Vadagarai Kilpidagai and Chinnakadu reserves has been reconstituted in order to form the new Chinnakadu Felling Series. Finally where two adjacent felling series with small annual coupes existed in the same beat, they were combined so as to give a bigger annual coupe, which could not only be more conveniently worked but would result in the concentration of exploitation and regeneration operations in one locality annually, thus facilitating inspection and supervision. The old Manpothai and Kolundumamalai Felling Series have been accordingly combined since both coupes supply the same set of villages, and no hardship on this score would result.

SECTION 3.—ANALYSIS AND VALUATION OF THE CROP.

341. *Analysis of the crop.*—With the exception of suitable areas of virgin forest added on to the various felling series wherever such a step was considered advisable, most of the felling series of the working circle consist of a series of age gradations from one year to a maximum of 30 years worked either under the " simple coppice " or " coppice with standard " system in the past. The only new felling series are the Unipattimalai and Alagarkoil series in Srivilliputtur range, the Sivasalem and Govindaperi Felling Series in Ambasamudram range and the Nambikoil Felling Series in Nanguneri range. These felling series have been constituted in order to increase the local supply of fuel for which there is a keen demand and thereby reduce illicit removals, and also with a view to improve the nature and density of the growing stock by artificial regeneration. For reasons simliar to those advanced in paragraph 296 above no detailed enumeration or valuation surveys of the growing stock were conducted.

SECTION 4.—METHOD OF TREATMENT.

342. *Silvicultural system.*—The working circle will be worked under the system of " Simple Coppice ", natural coppice and seedling regeneration being supplemented on a modest scale by artificial means. The system is advocated because it provides the easiest and least expensive means of regenerating fuel forests and ensuring a perpetual yield.

343. *Rotation.*—The following table gives the results of ring countings at breast height of some of the principal species in selected felling series.

	Species.	Name of felling series.	Number of trees.	Average mean annual girth increment.
1	*Acacia planifrons*	Valaikulam	20	0·46
2	*Albizzia amara*	Valaikulam	30	0·52
		Vasudevanallur	32	0·63
3	*Albizzia lebbek*	Karuppasamikoil	16	0·70
		Koriar	17	1·07
4	*Albizzia procera*	Kadayanallur	28	0·76
		Vasudevanallur	17	0·77
5	*Anogeissus latifolia*	Alagarcoil	22	0·55
		Kadayanallur	14	0·47
6	*Chloroxylon swietenia*	Karuppasamikoil	10	0·60
		Kadayanallur	7	0·47
7	*Dalbergia multiflora*	Rengarkoil	16	0·25
8	*Dalbergia sissoids*	Kuttalam	13	0·79
		Kadayanallur	22	0·52
9	*Grewia tiliæfolia*	Koriar	21	0·52
10	Teak	Kadayanallur	30	0·64
11	*Terminalia paniculata*	Kuttalam	15	0·80
12	*Pterocarpus marsupium*	Kadayanallur	11	0·47
		Karuppasamikoil	7	0·60
		Vasudevanallur	21	0·57

Too much reliance cannot however be placed on these averages as the rings in species such as *Pterocarpus marsupium*, were difficult to distinguish and in most of the other species except teak, the rings as actually counted did not always agree with the age of the coupe. This latter fact may have been due either to the presence of old standards in the coupes which would give a larger number of rings, or to illicit fellings in the past, which would account for a smaller number of rings. With the exception of the *Albizzias* which are fast growing, the average mean annual girth increments for most of the other species may be assumed to be in the vicinity of 0·55 inches which on a 30-year rotation would give a pole of 16·5 inches girth.

Apart from theoretical considerations a long rotation is advisable—

(*a*) to get a large proportion of the crop in these dry areas to attain an average girth of 16 inches so that a large fuel yield per acre may be obtained;

(*b*) to extend as long as possible the intervals between successive clear fellings of the growing stock, which in the prevailing dry climate and generally poor soils cannot but have a deleterious effect;

(*c*) to permit a small proportion of the more valuable species growing on patches of good soil, to attain small timber dimensions; and

(*d*) to allow natural seedling and artificial regeneration (prescribed below) to attain some degree of maturity before felling.

On the other hand too long a rotation would result in a reduction of the area annually felled and thus restrict the supply of fuel, and might possibly seriously impair the coppicing powers of the stools. On a consideration of the above arguments therefore a rotation of 30 years appears most suitable. This rotation is accordingly prescribed.

344. *Regulation of the yield.*—The yield is regulated by area. In each felling series therefore the size of the annual coupe is obtained by dividing the total area by the period of the rotation. Owing to the fact that during the previous rotation, the working of the coupes has been unmethodical, the necessity for exploiting the oldest age class has resulted in an allocation of coupes which may appear both unsystematic and capricious. No other alternative was possible without a culpable sacrifice of increment by the felling of immature crops. In the laying out of the annual coupe natural features such as ridges and streams have been followed as far as possible, both with a view to facilitate extraction to make demarcation less difficult and expensive.

SECTION 5.—METHOD OF EXECUTING FELLINGS.

345. *The annual coupe.*—The size of the annual coupe varies from 30 acres to 100 acres. All coupes or portions of coupes which have been found unworkable in the past have been deleted from every felling series if inspection disclosed that such a step was advisable. The working plan indicates the sequence of coupes and allots them to definite years. Every effort should be made to dispose of the annual coupe. It is expected that the non-sale of a coupe in a particular year will be of exceptional occurrence, since fuel is in great demand throughout the division and the system of working has been long established.

346. *Laying out of the annual coupe.*—The annual coupe will be demarcated on the ground in accordance with the felling series map, by cut lines 10 feet wide except where the boundary is a well defined river or stream. Its correct area will be computed on the basis of actual survey which must be done by an officer not below the grade of Range Officer who will certify to the accuracy of the survey. The importance of the District Forest Officer exercising a personal check over this work, which is often inaccurately done by range officers, is emphasized; it is recommended that he should check at least 25 per cent of the coupe surveys annually before the coupes are put up for sale.

Unless a departure from the boundaries of the coupe as laid down in the felling series map is involved on account of unforeseen difficulties on the ground, or the possibility of increasing the area of the coupe by including a suitable adjacent bit of forest excluded from the felling series, the difference between its nominal area and the actual area will not constitute a deviation requiring sanction.

347. *Division into strips.*—Each coupe will be divided into not less than three strips by cut lines 6 feet wide running as a rule across the contours. In cases where the greater length of a coupe runs across the contours this rule may be relaxed and strip lines made to run along the contours, if considerable economy in the cutting of lines is apt to result thereby. In all such cases the most elevated strip should preferably be worked first. All annual coupe surveys will be completed by the Range Officers and submitted to the District Forest Officer by the end of October.

348. *Indicator areas.*—The District Forest Officer will be guided in this respect by the prescriptions laid down in paragraph 303 governing the Timber cum Fuel Working Circle. The results of all indicator area measurements will be entered in the control book.

349. *Agency of fellings.*—The fellings will be conducted through the agency of contractors as the system has been long established and departmental extraction in the past has proved less remunerative. The coupes will be put up for sale early in the previous December so as to provide time for resale by auction, or the disposal of the coupe by tender, in case prices obtained at the sale are unsatisfactory. The system of selling coupes in the respective range headquarters instead of at Palamcottah the divisional headquarters, has been amply justified by results and will be continued. The coupe will be conveyed to the lessee on the 1st of April, a voidah of 12 months being allowed. Coupes unsold in time or leased subsequently on tender should not ordinarily have an extension of voidah beyond the 31st of the following March as such extensions unduly interfere with regeneration operations. Range Officers should ensure by frequent inspection that the work of felling and removals is effected at such a rate that these operations are completed by the end of the period of the contract. In exceptional circumstances, if extension of voidah is essential to avoid injustice to the contractor, the District Forest Officer will address the Territorial Conservator on the matter who will allow it, if he considers it advisable.

350. *Coupe arrears.*—Any portion of the annual coupe left unworked by the contractor after the termination of the period of his contract will be surveyed by the Range Officer and its area computed. The District Forest Officer will put up the arrear area for sale as soon as possible after it has been surveyed allowing such voidah as he considers necessary to enable the contractor to fell and remove the produce on it. In case however the District Forest Officer is satisfied that the arrear portion contains very poor growth or that it is inexpedient to clear fell it or that it is difficult or unremunerative to work it, he may depart from this rule, and the area may remain unfelled. Full reasons for such a step will be recorded in the Control Book.

351. *Reserved species.*—All sandal, *Terminalia chebula*, tamarind, bamboo, palmyra and *Bombax malabaricum* occurring in the annual coupe shall be reserved. The retention of these species is prescribed because they are not regular fuel yielding species and their value as timber or minor forest produce yielding trees is much greater than their fuel value. The District Forest Officer may after inspection authorize the felling and removal of old, crooked or otherwise unsound trees of all reserved species except sandal; but power to do this must be explicitly reserved in any Minor Forest Produce Lease that may be effected.

In the case of all tamarind trees so felled, root wounding around the stump will be done by the coupe contractor as it has been found experimentally that such treatment usually yields a crop of root suckers.

Other species may be added to the list by the District Forest Officer subject to the approval of the territorial Conservator, but the number should be limited, as reserved trees in a coupe are a source of annoyance to the contractor.

352. *Felling rules.*—(1) The felling shall proceed from strip to strip and the strips shall be arranged whenever possible so that arrears of fellings can be conveniently added to the succeeding year's coupe.

(2) All trees of the following species shall be cut by the lessee at a height of not less than 2 feet from ground level and the bark all round the stump shall be peeled off, with a view to killing the stump as these species are useless as fuel or timber.

(*a*) *Gyrocarpus jacquini.*

(*b*) *Cochlospermum gossypium.*

(*c*) *Dalbergia paniculata.*

(*d*) *Balsamodendron berryi.*

(3) *Euphorbia tirucalli* shall be cut at ground level but not coppiced.

(4) All strobilanthes in the annual coupe will be cut at ground level below the prop or stilt roots, heaped in patches over the area and burnt by the lessee. The eradication of this weed is a matter of the first importance and the result of annual operations should invariably be recorded in the Control Journal.

(5) Lantana is not common except in parts of the Sivasalem Felling Series. Wherever it occurs in the annual coupe it shall be uprooted by the lessee and burnt in patches.

353. *Coppicing.*—The prescription in paragraph 308 regarding coppicing will apply to the coupes of this working circle.

354. *Disposal of felled material.*—All felling shall be done by the contractor's coolies and the contractor or his accredited agent, shall be present in the coupe whenever felling or removals are in progress. All fuel billets not removable on head load permits should, it is suggested, be stacked in stacks of uniform measurements. The local units vary according to locality and it is desirable to introduce uniformity if this is possible. It is recommended that a stack measuring 5 feet × 4 feet × $2\frac{1}{2}$ = 50 stacked cubic feet be adopted. Removals of fuel below 6 inches in girth on head load permits will be permitted without prior stacking subject to the restriction in paragraph 357 below; but such permits will be issued only inside the coupe itself. All small timber shall on felling and conversion be hammer marked by the local beat guard before removal; the latter will submit in his weekly diaries an account by species of the timber so measured; the Range Officer will submit monthly abstracts of these accounts for each felling series to the District Forest Officer, and a consolidated abstract of the total yield from each felling series will be recorded in the Control Book. In accordance with Chief Conservator's Proceedings Mis. No. 364, dated 15th August 1933, it is suggested that arrangements be made to limit the number of head load permits that the contractor may issue due regard being paid firstly to the "possibility" of the coupe in the matter of faggot wood and secondly to the department's requirements in the way of suitable material for burning on rab patches.

SECTION 6.—TABULAR STATEMENT OF FELLINGS.

355. *Statement of fellings.*—The following table gives the sequence of fellings in each felling series :—

Year of working.	Coupe number.	Felling series.										
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1934–35	I	54·0	74·0	67·0	67·0	49·0	90·0	100·0	70·0	53·0	117.0	44·0
1935–36	II	54·0	75·0	67·0	67.0	50·0	93·0	100·0	71·0	43·0	70·0	44·0
1936–37	III	54·0	75·0	67·0	67·0	50·0	93·0	100·0	73·0	43·0	72·0	44·0
1937–38	IV	54·0	80·0	67·0	67·0	50·0	92·0	97·0	73·0	48.0	71·0	43·0
1938–39	V	54·0	75·0	64·0	67·0	50·0	125·0	97·0	73·0	48·0	72·0	43·0
1939–40	VI	54·0	75·0	67·0	67·0	50·0	100·0	97·0	69·0	44·0	72·0	44·0
1940–41	VII	54·0	75·0	62·0	67·0	50·0	100·0	96·0	68·0	43·0	70·0	43·0
1941–42	VIII	54·0	75·0	67·0	67.0	50·0	100·0	92·0	66·0	43·0	70·0	44·0
1942–43	IX	54·0	78·0	67·0	67·0	50·0	100·0	100·0	70·0	43·0	70·0	44·0
1943–44	X	54·0	75 0	67·0	67.0	50·0	100·0	100·0	70·0	43·0	70·0	45·0
												44·0
	Total ..	540·0	757·0	662·0	670·0	499·0	993·0	979·0	703·0	451·0	754·0	438·0

Year of working.	Coupe number.	Felling series.										
		(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1934–35	I	80·0	63·0	54·0	40·0	56·0	75·0	20.0	50·0	56·0	43·0	67·0
1935–36	II	66·0	63·0	51·0	40·0	56·0	72·0	21·0	60·0	50·0	43·0	88·0
1936-37	III	76·0	67·0	52·0	40·0	51·0	72·0	23·0	40·0	55·0	43·0	87·0
1937–38	IV	73·0	61·0	52·0	40·0	56·0	74·0	20·0	40·0	50·0	47·0	88·0
1938–39	V	72·0	70·0	52·0	40·0	51·0	72·0	21·0	40·0	56·0	46·0	88·0
1939–40	VI	74·0	64·0	50·0	40·0	54·0	70·0	21·0	41·0	53·0	47·0	87·0
1940–41	VII	73·0	65·0	52·0	40·0	54·0	75·0	21·0	40·0	56·0	47·0	100·0
1941–42	VIII	73·0	66·0	54·0	46·0	58·0	74·0	23.0	40·0	53·0	50·0	100·0
1942–43	IX	80·0	67·0	54·0	46·0	57·0	72·0	22·0	40·0	53·0	45·0	100·0
1943–44	X	77·0	66·0	54·0	40·0	59·0	71·0	21·0	40·0	51·0	49·0	100·0
	Total ..	744·0	652·0	525·0	412·0	552·0	727·0	213·0	431·0	533·0	460·0	905·0

SECTION 7.—SUBSIDIARY REGULATIONS.

356. *Artificial regeneration.*—The necessity for reclothing fuel areas is clearly recognized and requires no elaborate justification. Unless the adverse effects of clear felling are counteracted by artificial measures, it will not be long before such a deterioration of fuel areas has occurred that larger and more remote coupes will have to be worked. The consequence will be a lower yield per acre and comparatively higher extraction costs, and hence a rise in the price of fuel. Two factors control the scope of regeneration operations by rab sowings alluded to in paragraph 313 above :—

(*a*) the existence of sufficient felled material in a coupe after exploitation to provide slash for burning; and

(*b*) the cost of the operation in relation to the results obtainable.

In this division exploitation is so complete that hardly any slash is left in most of the annual coupes, the average head load removals per annum amounting to 171,568. Any great restriction of such removals would be a real hardship to a number of the poorer classes many of whom get their whole fuel supply by this means or have long made their living by collecting such faggot wood.

Again the technique of rab regeneration has not been sufficiently developed to justify its practice over large areas. These two considerations render it advisable therefore to limit the scope of regeneration operations to such portions of the annual coupe as are most in need of them.

357. *Rab regeneration.*—At the time of survey of the annual coupe the Range Officer will select blocks of forest in each strip where the density of stocking is below 50 per cent. Each such block shall not be less than 3 acres or more than 5 acres in extent, and shall have as far as possible a regular shape, i.e., be bounded by straight lines. The total area covered by such blocks should not exceed 25 per cent of the area of the annual coupe. Only such areas as contain soil suitable for tree growth shall be selected for artificial regeneration. The District Forest Officer shall inspect the areas selected and alter them if necessary, the blocks ultimately approved of being surveyed and demarcated by a cleared line 6 feet wide and rough stone cairns at salient points, and also marked on a map of the coupe on a scale of 16 inches to 1 mile. In the blocks ultimately approved of, the District Forest Officer shall by a clause in the contractor's agreement reserve to himself the power of requiring the contractor to stack all slash below 3 inches in girth in broken lines at suitable intervals (½ chain apart is suggested) running along the contours. The ' rabs ' shall be about 4 feet high and about 4 feet wide and care shall be taken that the slash is not stacked within 2 feet of the stool of any good fuel or timber species. All such rabs in a particular strip shall be completed satisfactorily before the contractor is permitted to fell the succeeding strip.

358. *Choice of species.*—The species selected for regeneration will naturally vary according to the type of forest to be regenerated. The cardinal principles to be borne in mind in regeneration operations will therefore be, to increase the stocking of such species as are valuable as fuel or small timber which are observed to thrive best in the locality, and also to introduce such of the valuable exotics as have been successfully raised in other divisions under similar conditions of soil, rainfall and climate. Thus in the xerophytic forests of Vallanad Felling Series species such as *Acacia planifrons* and *leucophlœa* and *Dalbergia multiflora* of the indigenous species, and *Acacia auriculiformis* and *Cassia siamea*, among the exotics, are recommended. *Prosopis spicigera* should also be tried. In the moister forests of the Valaikulam Felling Series and similar localities, the introduction of *Albizzia amara* and *lebbek*, as well as such of the species referred to above as are of value is indicated. In the still better felling series the choice of species is larger, and may include *Chloroxylon swietenia*, *Acacia ferruginea*, etc. In addition it is recommended that in these felling series, which, owing to their situation on the outer slopes of the ghauts receive a comparatively large amount of rainfall, the following species which are either evergreen or deciduous for comparatively short periods of the year, be tried in suitable localities, as in these dry forests it is a matter of considerable importance to improve the factors of locality by providing suitable shade and soil covering—

(1) *Tamarindus indicus.*

(2) *Schleichera trijuga.*

(3) *Eugenia jambolina.*

(4) *Pongamia glabra.*

(5) *Calophyllum inophyllum.*

These species are valuable both as fuel and minor forest produce yielding trees.

The following table shows the species recommended for artificial regeneration in each felling series, but is not intended to be exhaustive :—

Serial number of felling series.	Species advocated.
3, 15 and 22	*Acacia planifrons, leucophlœa,* and *auriculiformis. Prosopis spicigera, Cassia siamea, Dalbergia multiflora.*
	Acacia planifrons and *leucophlœa, Cassia siamea, Prosopis spicigera, Albizzia amara* and *lebbek* and *Dolichandrone crispa.*
5 to 14, 17, 19 and 20	*Teak, Chloroxylon swietenia, Pterocarpus marsupium, Azadirachta indica, Albizzia lebbek* and *odoratissima, Acacia ferruginea* and *leucophlœa, Swietenia macrophylla, Tamarindus indicus, Schleichera trijuga, Eugenia jambolina, Pongamia glabra, Calophyllum inophyllum.*

It is important that the District Forest Officer should consult the Provincial Silviculturist frequently as to the best species and the method of their introduction for any particular locality.

359. *Timber species.*—The introduction of timber species such as teak, and *Pterocarpus marsupium* in any portion of this working circle is open to the criticism that these species are extremely unlikely to attain small timber dimensions during the period of the rotation. It must be remembered however that although these species are not in great demand for fuel, their pole growth 12 inches to 24 inches in girth is more valuable than the fuel value of the regular fuel species of corresponding girths. Besides the possibility of ultimately converting the more suitable of the felling series of this working circle into the more lucrative felling series of the Timber cum Fuel Working Circle should be envisaged. There is little doubt that with good fire protection and adequate reduction of the grazing incidence, some at least of the fuel series of this working circle would prove convertible at the end of a rotation. The presence of timber species in the crop would considerably facilitate conversion and enhance the future value of the growing stock.

360. *Method of executing rab sowings.*—In September the rabs in the strips on which felling and removals have been completed by the current year's coupe contractor will be burnt departmentally on a windless day, care being taken that a good hot burn is secured. The resulting ash will as soon as possible be raked into the soil; shallow broken trenches, 6 inches deep and 1 foot wide, will be dug along the centre of the burnt lines, and the mixture of soil and ashes, put back into the trench where the area is comparatively flat, and heaped up on the hill side of the trench, where the area is sloping, so as to minimize wash. Seeds of suitable species will be sown on the ridges formed as mentioned above, and covered with a thin layer of soil in order to minimize damage from insects, birds and vermin.

In the succeeding April, the areas to be regenerated artificially in the remaining portions of the previous year's coupe will be treated similarly. It is suggested that in the coupes of the Vallanad Felling Series and in all the felling series north of the Shencottah gap, the strips be so arranged that the greater portion of the regeneration work may be effected in September, i.e., before the north-east monsoon, as the south-west monsoon in these localities is both scanty and irregular.

361. *Seed collection.*—The collection of good seed at the appropriate season, and its careful storage are matters of the greatest importance, the progress of which should be carefully watched by the District Forest Officer. Attention is invited to Appendix II where particulars regarding the time of seeding and the locality of availability of the various species are given. The pre-treatment of seed with a view to accelerating germination, is a subject on which research is desirable, as, in this division, the rainfall is apt to be particularly capricious, varying both in quantity and in period, from year to year. The value of being able to guarantee germination within a fixed period, so that every advantage can be taken of such rain as does occur, is unquestionable; failure of artificial regeneration methods practised in the recent past, can often be traced to germination having occurred just before a period of drought. Experiments on this important subject will be conducted annually by the District Forest Officer in consultation with the Provincial Silviculturist, only the more important species being dealt with. An abstract of the results will be recorded in the Control Journal.

362. *Replacing of casualties.*—In the area sown before the north-east monsoon casualties will be replaced by sowing before the succeeding south-west monsoon, while areas sown before the latter monsoon will be resown where necessary before the succeeding north-east monsoon.

363. *Weeding.*—Weeding of the seed lines will probably be necessary in the second year after sowing. This problem will be dealt with by the District Forest Officer when it arises and he must keep a close watch on the expenditure incurred. Much of the weeding could probably be done by the beat subordinates free of cost.

SECTION 8.—OTHER REGULATIONS.

364. *Demarcation.*—Four salient corners of the annual coupe will be demarcated with cut stone slabs, showing the coupe number, the year of working, as well as the adjacent coupe number and its year of working. For this purpose all old coupe stones will be defaced and used wherever possible.

365. *Grazing.*—For reasons mentioned in paragraph 327 above, all coupes in the various felling series will be closed for a period of 10 years after felling. In addition the coupe under felling in each felling series will also be closed to grazing. It is neither necessary nor practicable to provide watering places for cattle within each felling series.

The cutting and removal of fodder grass in fuel coupes closed to grazing will be permitted free of charge and should be encouraged.

366. *Fire protection.*—No special measures for fire protection within the working circle are prescribed, as past experience has shown that increased expenditure on this, has not resulted in anything like a proportionate reduction in the fire incidence. The rigid closure of such areas as are burnt after a big fire has occurred is essential to allow of the recovery of the area and must be enforced. To be of effect such closure must follow immediately on the fire. The procedure to be adopted is detailed in paragraph 465 under prescriptions for the Grazing Working Circle.

Where young regeneration areas are burnt the District Forest Officer will after inspection order the cutting back of all damaged regeneration, if such a step appears necessary. This work could often be done by the beat subordinates themselves but in the case of large areas the work will be done departmentally, the cost being met from the fire-protection estimates.

367. *Agricultural implements.*—For reasons mentioned in paragraph 329 supra, it is not necessary or advisable to constrain contractors to maintain a minimum supply of agricultural implements in their depots especially as investigation among the ryots has not disclosed any shortage in the supply of such produce.

368. *Charcoal burning.*—Charcoal burning will be permitted on request by the contractor in all the annual coupes. Not more than two pits will be permitted on any 1 acre. The contractor will be required to clear all inflammable material for a radius of 30 feet round each pit before burning, and will be liable to forfeit his security deposit in case his carelessness in this respect has caused a fire within the annual coupe.

369. *Illicit fellings.*—The contractor will be held responsible for all illicit feelings which occur within 10 chains of the boundary of the area leased out to him.

370. *Strobilanthes.*—Owing to the gregarious habit and rapid growth of strobilanthes it is a great menace to natural and artificial regeneration and its temporary eradication, at least, is essential to the preservation of coppice and seedling regeneration in the early stages. It is therefore prescribed that all strobilanthes found in the annual coupe in each felling series will be cut below the prop and stilt roots, heaped in patches and burnt by the lessee of the coupe. The results of such operations will be recorded in the Control Journal.

371. *Record of statistics.*—The contractor will be required to furnish monthly statements of removals of fuel and small timber to the Range Officer not later than the 25th of each month, showing the number of stacks or cartloads of fuel and the number of bags of charcoal removed, the quantity of fuel removed on headload permits and the species and volume of small timber extracted in cubic foot. The Range Officer will send a monthly abstract of these accounts for each coupe in his range, to the District Forest Officer so as to reach him by the first of the succeeding month. The total removals of fuel and charcoal and small timber from each annual coupe will be abstracted in the District Forest Office and entered in the appropriate column of the Control Book in tons. The following conversion factors will be adopted :—

26 bags charcoal—1 ton charcoal.
1 ton of charcoal—5 tons fuel.
125 stacked cubic feet fuel—1 ton fuel.
50 cubic feet timber—1 ton timber.
40 headloads fuel—1 ton fuel.

372. *Control.*—The following control records for the working circle will be maintained by the District Forest Officer :—

(*a*) Control Book.
(*b*) Record of Works.
(*c*) Regeneration ledger.
(*d*) Control Journal.

Entries in these records will be made in the order of felling series given in paragraph 340 above.

Control book.—All operations actually carried out annually in connexion with exploitation in each felling series will be entered in the appropriate columns of the control book full reasons for deviations if any, from working plan prescriptions being recorded in the remarks column. All coupe arrears will be entered in red ink and brought forward as the first entries, annually until finally disposed of.

Record of works.—All works carried out under the prescriptions and recommendation of the Working Plan, as well as measures neither prescribed nor suggested but carried out, will be recorded in this form.

Regeneration ledger.—The detailed costs of all artificial regeneration operations will be entered in this record.

Specimen forms with sample entries of these three control records are given in Appendices XIII, XIV and XVI respectively.

373. *Control Journal.*—This record will serve a similar purpose to that mentioned in paragraph 335 of the Timber cum Fuel Working Circle. Sample headings are given in Appendix XV but may be added to by the District Forest Officer with the previous sanction of the Conservator.

374. *Control maps.*—After the completion of fellings in each coupe under this plan, the area actually exploited will be marked with a light carmine wash, with the year of working entered in black ink in the middle of the coupe. In the case of arrear areas, the actual year of working will be noted in the middle of the arrear area, which will be distinguished by dotted carmine lines. Where the actual area leased out differs from that prescribed the actual area should be marked in dotted black lines.

A plan of the annual coupe in each felling series on a scale of 16 inches to 1 mile enlarged by the pentagraph or the method of squares, will show diagrammatically the position of the blocks artificially regenerated as well as the lay out of the rab sown lines, with particulars of the species sown. This will be filed annually with the Control Journal for the Working Circle.

CHAPTER V.—WORKING PLAN FOR THE CLEAR-FELLING WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

375. *Constitution.*—The working circle covers those areas in the Kariar, Serviar and Kalar valleys in Ambasamudram Range which are considered suitable for artificial regeneration with teak. These areas which are scattered, have been stock-mapped, and are indicated in the working plan maps. Portions of coupes III and IV of the Ambasamudram Evergreen Timber Felling Series are also considered suitable for teak plantations but have not been included in this working circle. It will be for the revising officer to consider as a result of ten years working of the coupes in the Evergreen Timber Working Circle whether it would be more profitable and desirable to convert such of the semi-evergreen forest as is suitable for teak in this locality into teak plantations.

376. In addition, all the existing teak plantations in this and the Kuttalam Ranges, together with the teak plantations proposed to be established during the period of this plan in the Kuttalam Range, vide paragraph 315 above, will be included in this working circle in order that their future treatment may be adequately controlled.

377. *Character of the vegetation.*—The vegetation consists generally of good quality semi-deciduous forest, the height growth varying from 35 to 70 feet. *Hardwickia pinnata*, *Chukrassia tabularis*, *Pterospermum rubiginosum* and *glabrescens*, *Stereospermum chelenoides*, *Vitex altissima*, *Nephelium longanum*, *Terminalia paniculata* and *belerica*, *Grewia sp.*, *Anogeissus latifolia*, *Cordia myxa* are some of the commoner species met with in the crop. Species of *Solanum*, *Curcuma* and the *Compositæ* are common seasonal herbaceous undergrowths. *Helicteres isora*, *and Murraya exotica* are the commoner woody shrubs. Climber growth is prolific in newly cleared areas.

378. *Division into felling series.*—Since all the areas suitable for planting are in one range only one felling series—the Ambasamudram Felling Series—will be formed.

SECTION 2.—BLOCKS AND COMPARTMENTS.

379. *Blocks and compartments.*—No permanent blocks are necessary, as the areas suitable for planting have been marked on the working plan map in three blocks and it is proposed that the area planted annually will be selected by the District Forest Officer from these three blocks.

380. *Boundaries.*—The boundaries of the plantations made in the past have often been so irregular, that the greatest difficulty is felt in recognizing them on the ground, and consequently the task of thinning or tending a particular plantation is rendered unnecessarily laborious. It is prescribed therefore that all future plantations shall be of regular shape preferably square or rectangular. With a view to saving money on the periodical maintenance of plantation boundaries in future, a belt of the existing forest 12 feet in width will be retained between two adjacent plantations. In this belt only tree growth above 1 foot in girth will be permitted to be felled. An additional advantage of the maintenance of such belts is, that contiguous plantations would be isolated from each other and the spread of insect pests such as defoliators and skeletonizers, reduced to some extent.

SECTION 3.—ANALYSIS AND VALUATION OF THE CROP.

381. *Valuation of the crop.*—The standing crop has been sold in the past for prices varying from Rs. 199 to Rs. 21 per acre—vide the table below :—

Year of plantation.	Area in acres.	Serviar valley rate per acre.	Area in acres.	Kariar valley rate per acre.
		RS.		RS.
1907	...	...	1·00	15
1917	32·00	50	...	...
1922	32.00	140	29.00	199
1923	29.00	30	26.75	47
1924	25.00	60	31.00	44
1925	...	...	3.50	$8\frac{1}{4}$
1932	9.35	21	10.75	27
1933	8·15	47	10.25	60

Excluding the year 1922 when the prices obtained were abnormally high owing to keen competition the average rate per acre for this type of forest amounts to Rs. 44 in the Serviar valley and to Rs. 43 in the Kariar valley. The standing crop in the Kani teak plantations appears to have been exploited departmentally. The following net profit per acre was obtained :—

Year of plantation.	Area in acres	Net revenue per acre.
		RS. A.
1912	5.19	34 2
1913	10.00	13 10
1914	5.00	8 13
1915	5.00	16 1

Since the areas to be exploited during the period of the plan are more remote, an average rate of Rs. 35 per acre may be expected.

SECTION 4.—METHOD OF TREATMENT.

382. *Silvicultural system.*—The silvicultural system will consist of clear felling and regenerating artificially a certain area annually in the Ambasamudram Felling Series.

383. *Choice of species.*—The principal species to be used in regenerating the clear-felled areas will be teak. With a view to securing an admixture of soil improving species, *Dalbergia latifolia*, and *Pterocarpus marsupium*, will also be introduced in the manner laid down in paragraph 395 below. There are places of limited extent which are likely to be, or to become, too swampy for teak. Such areas are to be regenerated with *Balanocarpus utilis*. There are also limited areas of very shallow soil and out crops of rock. The management will exclude such areas when laying out the annual coupe for regeneration, though they need not be excluded from exploitation.

384. *Rotation.*—It is too early to prescribe a rotation for teak plantations in the division as the oldest plantation is only 26 years old. The soil conditions are not conducive to the development of big timber on a long rotation. There is little doubt that teak grows much more slowly here than in Nilambur or in the adjacent Travancore State where the rotation is 70 years. Competition with the plantation teak from Travancore State is out of the question as not only is the teak faster grown owing to favourable soil and rainfall conditions but the plantations themselves are much more advantageously situated from the point of view of extraction. It will probably be found that it would pay best to work our plantations on a 40-year rotation, as besides the large revenue obtainable from the sale of the timber for which there is a great local demand, the

regeneration of the felled plantation from coppice would not be impracticable. For general purposes, such as calculating the size of the annual coupe it has been decided to adopt tentatively a rotation of 40 years. On this rotation the trees of the final crop are expected to attain an average girth of 3½ feet at breast height—vide paragraph 242 above. (Statistics of growth and yield.)

SECTION 5.—METHOD OF EXECUTIVE FELLINGS.

385. *The annual plantation.*—The area allotted to the felling series are as follows :— The annual plantation will therefore be 20 acres in extent.

Locality.	Area planted up to 1933.	Area available for planting.	Total.
	ACS.	ACS.	ACS.
Kariar	137	191	328
Serviar	136	178	314
Sivasalem	...	160	160
Total ...	273	529	802

The annual plantation will therefore be 20 acres in extent.

386. *Selection of area.*—Planting will be started in the Kariar valley and after the area in this valley is exhausted the Serviar valley will be taken up. The District Forest Officer will select the area to be planted annually from within the area marked in the working plan map as suitable for planting, subject to the conditions laid down in paragraph 380 above. The felling direction will be from east to west in order to mitigate damage from west winds; hence all the suitable area between the 1933–34 and 1924–25 plantations at Kariar will be exhausted first before the area west of the Kani teak plantation of 1915 is taken up for planting. The area selected will be surveyed by the Range Officer and demarcated by cleared lines 6 feet wide on the ground. This work will be completed by the end of October preceding the year of planting.

387. *System of exploitation.*—The annual area to be planted will be put up for sale by public auction early in November, the bid being per acre, and the coupe conveyed to the successful bidder by the 15th of December. The contractor will be constrained :—

(*a*) to fell and remove all saleable produce from the area by the 31st of the succeeding March;
(*b*) to reserve sufficient material on the ground to ensure a good burn. For this purpose removals on headload permits and charcoal burning will be prohibited;
(*c*) to spread the reserved material evenly over the area and burn it completely;
(*d*) to hand over the area in a state fit for planting by the 15th of the succeeding April at the latest.

If there is a likelihood of the contractor being unable to finish the work of felling removal and burning within the allotted period, any or all of these operations will be done departmentally and the cost thereof recovered from the contractor's security deposit. No extension of voidah beyond the 15th April will be granted on any account.

388. *Coppicing.*—All trees and undergrowth will be felled as close to ground level as possible but will not be coppiced. Creepers will be uprooted as far as possible.

SECTION 6.—TABULAR STATEMENT OF FELLINGS.

389. *Statement of fellings.*—The District Forest Officer will exhaust all the area marked on the working plan maps as suitable for planting in the Kariar valley, and then proceed to the Serviar valley. It is anticipated therefore that during the first nine years of the working plan period plantations will be restricted to the Kariar valley and the area in the Serviar valley will be taken up in the tenth year only.

SECTION 7.—REGENERATION.

390. *Burning.*—The desirability of getting a good even burn over the whole area to be regenerated cannot be over emphasized. Close departmental supervision of the contractor's work in this respect is essential. Burning should start about the middle of March and be completed by the middle of April at the latest. Piling and reburning are extensive operations and although they will be necessary to some extent, care exercised in the distribution and stacking of material before the first burn, will amply be repaid by reduced costs during the subsequent burns. It is not essential that every big log rejected by the contractor should be completely consumed.

391. *Inspection paths.*—After the burning is completed two inspection paths intersecting at right angles near the centre of the area to be planted will be laid out, with the aid of a prismatic compass. The paths will be absolutely straight, ungraded and

4 feet wide. No formation is needed beyond lock splitting the boundaries of the path on each side. These paths will be kept open and cleared of growth for a period of two years by the local subordinates.

392. *Lining and staking.*—The espacement will be 6′ × 6′. The lining and staking of the area taken up for regeneration will be completed by the end of April. Lining will be done by using two ropes which have been previously soaked in water and stretched to the limits of their capacity the first line being a foot in from the edge of the path. The correct method of carrying out lining, which will start at the intersection of the paths is described in detail on page 42 of the Madras Forest Pocket Book. At every six foot mark along the ropes, hardwood stakes, 3 feet long obtained from the nearest forest, will be driven firmly into the ground. Accuracy in lining greatly facilitates weeding, replacement of casualties and general supervision and is therefore desirable.

393. *Planting—Teak.*—Stumps from the nursery, vide section VIII will be planted in vertical holes made by crowbars or pointed wooden stakes of similar dimensions. In preparing the stumps not more than 1 inch of stem and from 8 to 9 inches of root will be retained, the balance being cut off with a sharp knife leaving a clean sloping surface; care should be taken that the minimum of separation between the bark and the cambium occurs. All side roots will be pruned and plants with double or malformed tap roots will be rejected. Stumping will be done immediately on removal of the seedlings from the nursery beds, and the stumps bundled in lots of 50 and covered with leaves as a precaution against dessication until planted. The operation of stump planting is simple and fairly well understood in the division. A hole is made about 4 inches away from the stake, of a sufficient depth to receive the whole of the root. The stump is inserted in this hole, and the surrounding earth levered into close contact with it. The following points are of the greatest importance :—

(*a*) The stump should be planted exactly up to the column, i.e., with only the stem exposed above ground level;

(*b*) the depth of the planting hole must be equal to the full length of the root, so that no distortion of the root results;

(*c*) great care must be taken to see that the stumps are planted with the earth tight round the tip of the root, as the initial roots spring, in a large percentage of cases from the last quarter of an inch of the stump and immediate contact with the soil facilitates early establishment. A cavity round the tip of the stump also tends to induce rot. The planting coolie should, therefore, test each stump to see that it is gripped at the tip before he closes the earth in round the upper part of the stump, and the subordinate supervising should test the work of each coolie by digging away the soil from the upper part of a few stumps, and feeling whether the stump is gripped by the soil round the tip;

(*d*) every stump must be firmly planted; only if it is resistant to a fairly hard upward pull should it be considered as satisfactorily planted.

394. *Time of planting.*—Early completion of planting is most desirable. As soon as the first showers in April or May have fallen and the ground is soft enough to enable the making of crowbar holes 9 inches deep, planting operations should be started. Once started, all available labour including the local subordinate staff should be put on the work, which should be finished with the minimum of delay. All planting operations should be completed in any case by the 15th of June as this date could never be too early, save in the case of an exceptionally abnormal monsoon.

395. *Other species.*—In the case of other species which have been prescribed as a mixture or for areas showing a tendency to swampiness (paragraph 383) the management will be at liberty to experiment until the most satisfactory method has been evolved. It is, however, recommended that the present system of dibbling 5 to 8 seeds of *Pterocarpus marsupium* on the side of the stake directly opposite to that on which the teak stump is, be continued. *Dalbergia latifolia* is best introduced by means of stump plants about a year old in quincunx in between alternate rows of teak. *Balanocarpus utilis* is easily raised from seed and should be dibbled. It has been found in Nilambur that even swampy ground can be regenerated successfully with teak provided stumps be planted early enough. This should be tried here, as an experimental measure. In order to ascertain the comparative amount of success obtained with each species or method it is prescribed that each quadrant (into which the plantation will be divided by inspection paths) be treated with the same species introduced under the same method.

396. *Casualties.*—It is absolutely essential to obtain as full a stocking as possible in the first year. To this end the concentrated effort of all concerned is necessary throughout both monsoons. Casualties must be replaced as they occur but it is not worth while doing this after the end of November. Care must be exercised to see that the supply of stumps for this purpose is sufficient. Experience has shown that given good stumps

properly planted at the correct time, and normal weather conditions, 90 per cent stocking can be achieved by the end of the first season.

397. The replacement of casualties in the second year is not advisable, carefully controlled experiments, made by the Provincial Silviculturist, having shown that such plants rarely take their place in the crop.

The Provincial Silviculturist must be consulted periodically in this matter.

398. *Agency of planting.*—The Kanis have consented recently to raise teak plantations in conjunction with field crops, i.e., by "ponam" in the Kariar valley. Past experience with these hill tribes does not justify the hope that they will make reliable and permanent ponamdars. However, they are worth encouraging by all reasonable concessions as they will not only save us the cost of weeding and replacing casualties but also guard the young plantation against sambhur attack and thus obviate the necessity for expenditure on fencing. According to them their desertions in the past have been due to the harsh treatment they received from the lower subordinates and it is of the greatest importance that the District Forest Officer should be in close personal touch with them and remove all real causes of grievance promptly.

399. An endeavour should be made to find ponamdars to form these plantations, and if successful the following rules will be observed :—

(1) The original planting with stumps will be done departmentally only lining and staking being done by the ponamdars under departmental supervision. This is because it is essential that planting should be well done and completed in the shortest possible time, and the labour force provided by the small settlement of ten Kani families would be insufficient for this purpose; besides the ponamdar is usually blamed for defective planting when responsibility is shared.

(2) The ponamdar will be permitted to cultivate tapioca, chillies and ragi. No vegetable creeper crops will be permitted. Plantain cultivation will be permitted only in areas where teak is not proposed to be regenerated, e.g., swamps and rocky areas.

(3) The ponamdar will be constrained to replace casualties as they occur and to do weedings as detailed in paragraph 411 below. The teak stumps or seedlings for the former purpose will be supplied to him departmentally.

SECTION 8.—NURSERY.

400. *The site.*—All nursery sites will be selected by the District Forest Officer. The essentials of a good site are detailed in the Madras Forest Pocket Book, page 28. In case ponamdars are available the nursery will be constructed close to the area to be planted. It is recommended that a portion of the current year's regeneration area be set apart for a nursery to provide stumps for the subsequent year's planting, as this will save the cost of preliminary clearing and burning of nursery sites. If this is done a sufficient number of seedlings will be retained in the nursery at an approximate espacement of 6′ × 6′ to ensure full stocking of the area.

In the absence of ponamdars it is preferable to have a permanent nursery at Mundanthorai, as past experience has shown that only then will the nursery secure the close attention that it requires. In the case of a permanent nursery it is absolutely essential to manure the beds annually, a layer of manure 2″ to 4″ thick being spread over them and turned in with the soil when it is worked up after the rains. Cheap nursery manure can be made by making a heap of alternative layers 6″ thick, of good soil, and a mixture of animal dung and vegetable litter. This mixture if left to mature for a year makes an excellent manure when mixed with wood ash.

401. *Preparation of site.*—The site will be aligned after it has been burnt and cleared, a convenient size for beds being 40′ × 4′; a pathway, a foot wide, will surround each bed which should run as far as possible across the contours to ensure thorough drainage. During the normal showers in early April the site will be dug up to a depth of 1 foot, and all stones, and small tree or shrub roots encountered will be removed and all clods of earth well powdered.

402. *Nursery beds.*—The beds will be formed from the excavated earth more soil being obtained from elsewhere if necessary; such beds will be from 6 to 9 inches above ground level and will be supported on all sides by split bamboo slats, held in place by stout wooden pickets firmly sunk into the ground. The surfaces of the beds will be given a slight camber to prevent stagnation of water.

403. *Fencing.*—The site shall be fenced with bamboo thorns and hardwood supports leaving one or more swing gateways as convenient. An 8 feet high fence erected 3 feet away from the nearest bed is sufficient.

404. *Seed.*—Owing to the inferiority of the indigenous teak it appears advisable to import good seed from a better strain of teak from elsewhere. Seed from South Coimbatore Division has been imported in the past, but it is too early to say whether the results have justified the extra expense involved. Mr. Barry who was District Forest Officer at the time was definitely against foreign seed as he obtained lower germination per cent and inferior seedlings from Coimbatore seed sown at Kodamady. With a view to reducing costs of transport it is recommended that seed from Ariankavu in Shencottah Division be obtained by arrangement with the divisional officer, for the first three years, half the nursery being sown with indigenous seed obtained preferably from the 1907 and 1912 teak plantations at Kariar and the remaining portion with Ariankavu seed. The stumps obtained in either way, will be planted in separate quadrants of each annual plantation, and observations regarding the germination per cent, height, growth and health of seedlings, and the subsequent growth of stumps recorded in the Control Journal. At the end of the triennium a decision will be arrived at by the District Forest Officer in consultation with the Territorial Conservator, as to whether the additional expense of imported seed is justified by the results. The Provincial Silviculturist must be consulted in this matter.

405. *Pretreatment of seed.*—All local teak seed should be collected from trees with well developed crowns in January and February and passed by the Range Officer before payments are made. The seed will be spread out in a thin layer on rock or hard prepared ground in order to weather for a week prior to sowing. In addition to this soaking the seed in water for 24 hours before sowing is recommended. Seed of *Pterocarpus marsupium* and *Dalbergia latifolia* will be soaked in a solution of cowdung and water for 48 hours before sowing, as this treatment has been found to accelerate germination. On the question of treatment of seed, the Provincial Silviculturist must be consulted.

406. *Quantity of stumps.*—The necessary provision must be made for original stocking of the clear-felled areas and replacement of casualties.

Under full working the following requirements per acre will be necessary :—

Original stocking of clear-felled areas	1,200	stumps.
Replacement of casualties in the first year, say 25 per cent	300	,,
Total ...	1,500	,,

407. Thus for 20 acres 30,000 one-year old teak stumps will be required each year.

Twenty beds 40′ × 4′, or their equivalent, should produce this required number of stumps, but to be on the safe side 25 such beds should be prepared.

408. Teak seed should be sown in them at the end of May or beginning of June with the seeds almost touching, i.e., approximately half an inch apart on the average. This requires about 1 to 1¼ bags of seed per bed 40′ × 4′. Germination is hastened by covering the beds with straw laid on twigs (*Phyllanthus emblica* twigs have been found most suitable) and watering through the straw. The straw should be removed as soon as germination has commenced. Watering will have to be done until the rains set in. The pricking out of seedlings into other beds is not recommended unless there is a shortage of seed. It is expensive and gives less satisfactory results than raising the plants direct from seed without transplanting. If desired a certain amount of thinning out may be done in the beds to about 3 inches espacement but this also is not really necessary. If on the other hand the beds are left unthinned there will be a number of suppressed plants left behind which will grow into suitable stumps as a reserve for the next year's work. Superfluous beds, if any, can be retained for use when the plants are two years old, but it may be advisable to use up the largest plants in them when twelve months old. As far as is known there is no disadvantage in using large two-year old stumps over an inch in diameter, but the Provincial Silviculturist should be consulted from time to time on this point, and upon the best methods of nursery work.

409. The aim should be to produce stumps of more than three-eighths of an inch diameter at the thickest part (the larger the better) at a reasonable cost. If it is found that local conditions are such that stumps of this size are not produced in 12 months the nursery should be started earlier.

410. *Nursery costs.*—It is essential to keep nursery costs as low as is consistent with obtaining the requisite quantity of good stumps. Since in the case of temporary nurseries preliminary clearing and burning will be done by the coupe contractor and the fencing and subsequent tending of seed beds by the Kani ponamdars and local subordinates only the costs of collection of the seed, of preparation of the ground, of formation of the beds, need be incurred departmentally; without going into details it is estimated that

nursery charges should not exceed Rs. 3 per acre of clear felled area. The management of a nursery is one of the most important of a ranger's duties; all details of nursery work must therefore be closely supervised by him, and responsibility for bad work must not be shifted to the ponamdars. In case ponamdars are not available, a permanent nursery large enough to supply the annual quantity of teak and rosewood stumps will be established at Mundanthorai. But the Provincial Silviculturist should be consulted as to the number of years for which it is advisable to use such a permanent nursery.

SECTION 9.—SUBSIDIARY SILVICULTURAL REGULATIONS.

411. *Weeding—(a) In the year of formation.*—As this work will be done by ponamdars no precise number of weedings will be prescribed; weeding will consist of uprooting all grass, creepers and herbaceous plants for a radius of 1 foot around each stump or seedling. Natural coppice, root suckers and seedlings of timber species such as rosewood, *Chukrassia tabularis* and *Hardwickia pinnata* will be encouraged, as both an early closing of the canopy and a mixture of species will be secured thereby. Such species however will not be favoured at the expense of teak. Coppice regrowth of all fuel or useless species will be cut back. Weedings will commence immediately after the completion of planting and will continue progressively quadrant by quadrant, over the whole area till the end of October. In this manner the whole area will be worked over at least twice.

It is most important that all casualties found during the course of weeding be replaced promptly. Early in January a final weeding of the whole area accompanied by a careful scraping of the soil to a width of 2 feet on each side of each row of teak plants in order to improve æration, and reduce roots competition, will be done. It is also recommended that mulching be done simultaneously, as the joint operations will assist the young plant in tiding over the period of drought from February to May.

(*b*) *Second year weeding.*—This will be done departmentally and will be commenced by the 15th April and completed as soon as possible. Clean weeding in 18 inches diameter patches round stumps or scraping as above shall be done. In addition working of the soil round all small plants and replaced casualties will be done in September-October.

(*c*) *Third year weeding.*—Normally no weeding should be necessary in the third year. A decision as to its necessity will be arrived at by the District Forest Officer in consultation with the Territorial Conservator.

(*d*) The Provincial Silviculturist must be consulted periodically as to the latest weeding practice since it is being improved annually.

412. *Pruning and cutting back.*—Pruning should be done if at all necessary only during the third year; when forked stems and stout side branches should be carefully pruned flush with the main stem without laceration of the bark.

During the first weeding in the second year all badly damaged teak shall be cut back at ground level with a sharp bill-hook by a clean sloping cut with the minimum of separation between bark and cambium. Surplus shoots from stumps shall be reduced to the best one at the same time.

413. *Cleanings.*—In the fifth year after formation the District Forest Officer shall inspect the plantation and order a cleaning if it is required. It will probably be found necessary to remove bamboo, lantana, creepers and climbers, and also soft wood tree species such as *Helicteres isora*, *Grewia sp.*, and *Sterculia sp.*, which are found to overtop the teak. Bamboo regrowth should be cut back as often and as soon as young shoots appear during the tending operations in the first few years and also in the fifth year cleaning, if necessary. Lantana should be completely uprooted.

414. *Thinnings.*—It is not expected that any of the plantations raised under these prescriptions will require to be thinned during the period of this plan. No thinning is therefore prescribed; but should inspection by the District Forest Officer show that this operation is desirable in any such plantation, it shall be carried out with the previous sanction of the Territorial Conservator.

It is prescribed that the District Forest Officer or his gazetted assistant shall mark all thinnings which are prescribed in the Tabular Statement of Operations in paragraph 416 below, which relates to the existing plantations. It is recommended that marking and felling of the trees to be removed be carried out simultaneously as only then can a correct appreciation of the intensity of the thinning be arrived at. Teak in the division is comparatively fast growing in its youth once the precarious years of establishment of the crop are passed; hence the process of suppression is rapid at this stage. The first

thinning should therefore be rather heavy, so that the trees retained may be able to respond quickly. As a rough guide to marking officers the following marking rules are recommended :—

(*a*) About 30 per cent of the crop may be removed with safety in the first thinning.

(*b*) Any form of mechanical thinning, should be avoided.

(*c*) The poorer the growth, the lighter must be the thinning.

(*d*) The main object of the earlier thinnings should be to give room for crown development to promising stems evenly distributed over the plantation; these should be selected from dominant or subdominant stems.

(*e*) Suppressed trees should not be felled if they are not saleable at a profit.

(*f*) A very poor teak pole should not be preferred to a really good pole of any other saleable species.

(*g*) All dead or dying teak poles should be removed in thinnings.

(*h*) The understorey of miscellaneous species should be carefully preserved.

(*i*) All bamboos and climber growth should be cut back during the thinnings, and all miscellaneous tree growth interfering with the growth of teak should be felled as near ground level as possible and allowed to coppice.

(*j*) All misshapen trees, even if dominant should be removed.

(*k*) In the process of felling care must be exercised to do as little damage as possible to the trees retained.

(*l*) All marked trees should be counted as a check and their number recorded.

415. *Thinning cycle.*—It is considered that a five-year thinning cycle will prove satisfactory and it is therefore prescribed.

SECTION 10.—TABULAR STATEMENT OF OPERATIONS.

416. *Cleaning and thinning.*—The plantations to be cleaned or thinned during each year of the working plan period are mentioned below :—

Year of operation.	Range.	Locality.	Nature of operation. Cleaning year of plantation.	Area in acres.	Thinning year of plantation.	Area in acres.
1934–35 ..	Ambasamudram ..	Kariar ..	..	..	1913–14	10·00
		Do. ..	..	..	1923–24	26·75
		Serviar ..	..	..	1922–23	32·00
1935–36 ..	Do. ..	Kariar ..	..	..	1914–15	5·00
		Do. ..	..	..	1922–23	29·00
		Serviar ..	..	..	1923–24	29·00
1936–37 ..	Do. ..	Kariar ..	..	..	1907–08	1·00
		Do. ..	..	..	1912–13	5·00
1937–38 ..	Do. ..	Kariar ..	1932–33	10·75	1915–16	5·00
		Serviar ..	Do.	9·60	1917–18	32·00
	Kuttalam ..	Kuttalam ..	Do.	12·50	..	..
1938–39 ..	Ambasamudram ..	Kariar ..	1933–34	10·25	1924–25	31·00
		Serviar ..	Do.	8·15	Do.	25·00
	Kuttalam ..	Kuttalam ..	Do.	11·90	..	..
1939–40 ..	Ambasamudram ..	Kariar ..	1934–35	10·00	1913–14	10·00
		Do. ..	..	..	1923–24	26·75
		Serviar ..	1934–35	10·00	1922–23	32·00
	Kuttalam ..	Kuttalam ..	Do.	10·00	..	..
1940–41 ..	Ambasamudram ..	Kariar ..	1935–36	20·00	1914–15	5·00
		Do. ..	..	..	1922–23	29·00
		Serviar ..	..	..	1923–24	29·00
	Kuttalam ..	Kuttalam ..	1935–36	10·00	..	..
1941–42 ..	Ambasamudram ..	Kariar ..	1936–37	20·00	1907–08	1·00
		Do. ..	..	..	1912–13	5·00
	Kuttalam ..	Kuttalam ..	1936–37	10·00	..	..
1942–43 ..	Ambasamudram ..	Kariar ..	1937–38	20·00	1915–16	5·00
		Do. ..	..	..	1932–33	10·75
		Serviar ..	..	..	1917–18	32·00
		Do. ..	..	..	1932–33	9·60
	Kuttalam ..	Kuttalam ..	1937–38	10·00	Do.	12·50
1943–44 ..	Ambasamudram ..	Kariar ..	1938–39	20·00	1924–25	31·00
		Do. ..	..	..	1933–34	10·25
		Serviar ..	..	..	1924–25	25·00
		Do. ..	..	..	1933–34	8·15
	Kuttalam ..	Kuttalam ..	1938–39	10·00	Do.	11·90

NOTE.—The areas of plantations to be formed during the period of the plan are only approximate.

SECTION 11.—OTHER REGULATIONS.

417. *Fire protection.*—The danger to the plantations from fire is negligible since the forest is semi-evergreen, comparatively remote from human habitations, and never visited by graziers. No special protection measures are therefore prescribed. The whole working circle will however be generally protected, and any fire that may occur must be immediately extinguished by the local subordinates and fire patrols.

418. *Protection against animals.*—All the plantations will be strictly closed to grazing, and bulls of carts used by contractors will be rigidly excluded from young plantations.

It is difficult to keep wild animals out of plantations as the cost of fencing is prohibitive; while ordinary fencing is of little utility against big animals such as sambhur and pig, wire fencing is equally inefficacious against smaller ones such as hare, porcupine, etc. As long as ponamdars are available, they can be relied upon to keep away wild animals from the annual plantation, in the interests of protecting their own field crops. The protection of older plantations, two to three years old may possibly be secured by the erection of rough ' scare crows ' in strategic positions. If this method fails and special protection appears necessary it will be for the management to consider the merits of wire fencing, some form of tight-lock fencing probably being best.

419. *Protection from insects.*—Defoliators and skeletonizers are not yet responsible for a great deal of damage in these localities; should they become serious pests the advice of the Forest Entomologist must be obtained.

420. *Protection from fungus.*—Fungus attack has been responsible for some damage in the existing plantations—vide paragraph 60 above. All infected trees should be cut and removed when noticed during the periodical cleanings or thinnings.

421. *Departmental plantations.*—In the event of the kanis proving inefficient or untrustworthy as ponamdars, the work of raising the plantations will be undertaken departmentally. No change in the use of one-year old teak stumps, an espacement of 6′ × 6′, the method of mixture of species, the manner of planting and replacement of casualties will be effected. Modification of the weeding prescriptions will however be necessary. During the first year, a first weeding consisting of grass and weed cutting over the whole area and clean weeding with uprootal of all weeds to a radius of 1 foot around each stump will be done in July. This will be followed by forking in lines 2 feet broad on each side of each row of plants in October. A third and similar weeding will be done in January accompanied by mulching around each stump plant in order to conserve the moisture in the soil as long as possible.

In the second year two weedings similar to the last weeding mentioned above will be done—one in April-May and the other in September-October.

422. *Costs of departmental operations.*—The following is an estimate of the cost of departmental operations per acre of plantation :—

	RS.	A.	P.
Nursery charges	3	0	0
Cost of stakes	1	8	0
Lining and staking	1	0	0
Stump planting	2	8	0
First year two weedings	5	0	0
First year final weeding	3	0	0
Second year two weedings	6	0	0
Total ...	22	0	0

To this must be added the cost of introduction of rosewood stumps and dibbling of *Pterocarpus marsupium* and *Balanocarpus utilis* seed. Including cost of collection of seed, the expenditure on these items should not exceed Rs. 3 per acre of plantation.

SECTION 12.—CONTROL.

423. *General.*—The following control records will be maintained by the District Forest Officer who will be responsible for their correct posting :—

(*a*) The Control Book.
(*b*) The Record of Works.
(*c*) The Regeneration Ledger.
(*d*) The Control Journal.
(*e*) The Control Map.

(*a*) *The Control Book.*—In the Control Book will be recorded the felling prescriptions of the plan, the work carried out and the price obtained per acre.

(b) *The Record of Works.*—The Record of Works will be a record of all operations carried out in the working circle in connexion with regeneration and tending of the forest. It is essential that each year's plantation should be treated as a separate unit and that information against each item be accurately posted. The Control Form will be similar to that given in Appendix X for the Evergreen Timber Working Circle.

(c) *Regeneration Ledger.*—A Regeneration Ledger will be maintained for each teak plantation and will contain complete details of expenditure incurred annually on its formation, and tending. Items of expenditure under each head will be recorded monthly for the first two years, and thereafter annually. The record is intended to show at a glance the total expenditure incurred on a plantation and its correct maintenance therefore is of the greatest importance. A sample form is given in Appendix XVIII.

(d) *The Control Journal.*—A Control Journal will be maintained for the whole working circle and will consist of a detailed account of the management, and the extent to which the methods prescribed have been suitable, successful, economical or otherwise. As each plantation is formed its history will be written up by the District Forest Officer personally. Brevity is to be aimed at, but all information likely to be of interest to future Working Plan Officers will be recorded. A form similar to that given in Appendix XI, for the Evergreen Timber Working Circle, will be suitable.

(e) *The Control Map.*—A map of the area exploited and the area regenerated annually will be prepared on a scale of 16 inches to 1 mile, and kept on permanent record in the District Forest office. Such maps will show the lay out of the inspection paths, and the species or mixture of species planted or sown in each quadrant, with dates of original planting or sowing.

CHAPTER VI.—WORKING PLAN FOR THE SANDALWOOD WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE WORKING CIRCLE AND CHARACTER OF THE VEGETATION.

424. *Constitution.*—The working circle comprises—

(a) the whole of the Alagarcoil valley in Srivilliputtur range, 3,930 acres.

(b) the sandal area in Kuttalam reserves, 812 acres.

(c) the small patches of sandal which occur in the Padaramalai Timber cum Fuel Felling Series in Ambasamudram range, and the Valliyur reserve of Nanguneri range, area not assessed.

425. *Division into felling series.*—Only one felling series, the Alagarcoil Sandal Felling Series, will be constituted as both the extent and the youth of the sandal crop present in the areas (b) and (c) above do not warrant their exploitation, as the annual yeild would be a negligible quantity.

426. *Character of the vegetation.*—The sandal in the Alagarcoil valley and the Kuttalam reserve appears to have spread from the adjacent patta lands, where it was in all probability introduced in order to cater for the future needs of the important temples at Srivilliputtur and Kuttalam. It occurs in the reserves in typical deciduous forest, its growth in the Alagarcoil valley being dense; it is spreading here higher up the slopes where its stocking varies from light, i.e., 25 to 10 trees per acre, to scarce, i.e., less than 10 trees per acre (vide sandal stock map). In the Alagarcoil valley it occurs at elevations varying from 500 feet to 3,500 feet while in the Kuttalam reserve it does not appear to have spread beyond an elevation of about 1,000 feet.

Elsewhere in the division the sandal has been introduced departmentally and the growth does not appear to be more than 25 years old.

Three factors of importance to the future management are mentioned below: Firstly, sandal is definitely a root parasite and therefore has to rely on host trees for its healthy development; secondly, since the sandal growth in the division is young and therefore no mature trees exist; the extraction of only dead trees is justifiable; finally, sandal is very sensitive to fire and rigid protection from this danger is essential to the preservation of the sandal forest.

SECTION 2.—BLOCKS AND COMPARTMENTS.

427. *Blocks.*—The existing division of the Alagarcoil sandal area into nine compartments has been found inadequate because enumerations conducted by the working plan party have shown that a larger area has been invaded by sandal in this locality than was previously considered to be the case; all the old boundaries are therefore inconvenient to adopt for future management. The area has accordingly been divided into three blocks as shown below. In the above division the block boundaries have been as far as possible

laid down with a view to their utilization as fire lines. For purposes of extraction further subdivision of the blocks into compartments and sub-compartments may be found necessary. This will be left to the discretion of the management.

The sandal area in Kuttalam reserve has also been divided into three blocks. Elsewhere the sandal growth is too small in extent to make division into blocks necessary. Tending in such areas will be done annually by the beat subordinates. The following table shows the distribution of the blocks :—

Srivilliputtur Range.

Block number.	Block name.	Sandal bearing area. ACS.	Total area. ACS.
I	Pudupatti	1,500	2,045
II	Alagarcoil	1,265	1,645
III	Athithondu	1,165	1,375
	Kuttalam Range.		
I	Kuttalam	272	272
II	Do.	256	256
III	Do.	284	284

SECTION 3.—ANALYSIS AND VALUATION OF THE CROP.

428. *Enumerations.*—An abstract of a complete enumeration of the sandal in the Alagarcoil valley and Kuttalam reserve respectively, conducted by the working plan party, is given below :—

Alagarcoil Valley.

Girth classes.	3 to 6 inches.	6 to 12 inches.	12 to 18 inches.	18 to 24 inches.	24 to 30 inches.	30 to 36 inches.	36 inches and over.
Number of green trees ...	12,677	16,756	10,172	3,114	632	99	10
Number of dead trees ...	2,168	2,650	828	155	19	1	...
Total ...	14,845	19,406	11,000	3,269	651	100	10
Kuttalam Reserve.							
Number of green trees ...	4,737	2,992	902	263	63	10	2
Number of dead trees ...	15	32	5	4	...	...	...
Total ...	4,752	3,024	907	267	63	10	2

429. *Normality.*—The following table shows the percentage distribution of green sandal in the various girth classes in both sandal areas :—

Girth classes.	6 to 12 inches.	12 to 18 inches.	18 to 24 inches.	24 to 30 inches.	30 to 36 inches.	36 inchse and over.
Alagarcoil valley ...	54·43	33·04	10·11	2·05	0·33	0·04
Kuttalam reserve ...	70·70	21·31	6·21	1·49	0·24	0·05
Normal forests (North Coimbatore).	73.16	20·23	5·27	1·02	0·26	0·06

It will be noted that the distribution of girth classes as compared with that existing in the natural type of sandal forest in North Coimbatore is abnormal. The stocking in the lowest girth class is less than that in the next higher 6 inches girth class. This is accounted for by the fact that seedlings below the height of a man were not enumerated. Such seedling regeneration however is comparatively abundant in both sandal areas in the division.

430. *Capital value of the forest.*—In this division the task of assessing the capital value of the sandalwood forest is unduly difficult as data regarding the percentage of sapwood trees and the average outturn per tree in each girth class are not available, as extraction has been carried only since 1923 and the registers prescribed under the Sandalwood Extraction Rules maintained only since 1931. Adopting the percentage of sapwood trees and the average outturn per tree in each girth class as ascertained for sandal forests in North Coimbatore, the following estimate of the capital value of the forest has been arrived at for the Alagarcoil and Kuttalam sandal areas respectively. The lowest girth class, that below 6 inches, has been ignored.

	Alagarcoil sandal area.						Kuttalam sandal area.					
Girth class in inches.	6 to 12 inches.	12 to 18 inches.	18 to 24 inches.	24 to 30 inehes.	30 to 36 inches.	36 inches and over.	6 to 12 inches.	12 to 18 inches.	18 to 24 inches.	24 to 30 inches.	30 to 36 inches.	36 inches and over.
Number of green trees ..	16,756	10,172	3,114	632	99	10	2,292	902	263	63	10	2
Percentage of sapwood trees.	37·7	5·4	4·4	2·1	..	..	37·7	5·4	4·4	2·1	..	..
Number of sapwood trees..	6,317	549	137	13	..	..	864	49	12	1	..	..
Number of heartwood trees.	10,439	9,623	2,977	619	99	10	1,428	853	251	62	10	2
Average outturn of rough cleaned wood per tree in pounds.	5·2	17·2	54	115·3	200·3	271·2	5·2	17·2	54	115·3	200·3	271·2
Total quantity of heartwood in pounds.	54,283	165 516	160,750	71,371	19,830	2,712	7,426	14,672	13,554	7,149	2,003	542
Total rough cleaned wood in tons.	..	..	211·37	..	..	..	..	..	..	20·24	..	..
Deduct 3 per cent wastage of final cleaning in tons.	..	..	6·35	..	..	..	..	..	..	0·61	..	..
Grand total of final cleaned wood in tons.	..	..	205 02	..	..	..	..	..	..	19·63	..	..
Value at Rs. 800 per ton in rupees.	..	..	1,64,016	..	..	..	..	..	..	15 ,704	..	..

SECTION 4.—METHOD OF TREATMENT.

431. *Silvicultural system.*—Extraction will be limited to dead trees only, and will be conducted in accordance with the Sandalwood Extraction Rules. In addition all trees broken by wind, elephants, or any other cause will be felled and coppiced, or pollarded, according to whether the damage is caused to the stem or the crown respectively. All such trees or parts of trees will be brought to stock in case they contain scented heart-wood.

432. *Regulation of the yield.*—In a long established sandal forest it has been discovered by Mr. C. R. Ranganathan that normally, the number of trees which die annually in any particular girth class is a fixed proportion of the number of living trees in that class, and that this proportion is constant in all girth classes. The sandal forest in this division is far from normal—vide paragraph 429 above—the deficiency in the lower girth classes being attributable partly to the heavy incidence of fires in the past, and also possibly to suppression; fires have naturally exacted a heavier toll from the lower girth classes, as trees of the higher girth classes are more fire resistant owing to the development of thicker bark. Again it will be seen from the low incidence of death in the higher girth classes, vide table below, that extraction in the past has been both irregular and highly selective. Under these conditions any forecast of the yield is based on the past mortality per cent or on a fixed mortality per cent in each girth class is apt to be so speculative as to be of little value. The estimated yield of final cleaned sandalwood from the whole of the growing stock in the Alagarcoil valley and the Kuttalam reserve amounts to 224·65 tons—vide paragraph 430 above. Assuming on a conservative basis that the annual yield will be 2 per cent of the growing stock, extraction being limited to dead trees only, the annual yield will be 4·49 tons. The average annual yield for the decade 1923–24 to 1932–33 amounts to 3·35 tons. Vide table below :—

Year.	Yield. QRS.	LB.	OZ.
1923–24	61	2	10
1924–25	48	24	8
1925–26	63	12	0
1926–27	146	0	6
1927–28	95	10	3
1928–29	65	3	13
1929–30	352	4	14
1930–31	323	5	0
1931–32	653	0	12
1932–33	871	23	14
Total ...	2,680	4	0
	or 33·5 tons.		

An average annual yield of 4 tons during the period of the working plan would not seem therefore to be unduly optimistic. During the first felling cycle however the yield will be considerably curtailed as about 15 tons have been extracted during 1933–34.

433. *Felling cycle.*—A felling cycle of three years will be adopted as this will ensure that the annual coupe is of convenient size for extraction and tending purposes, and that dead trees are not left unduly long in the forest to permit of theft or destruction by fire.

434. *Calculation of the yield.*—Enumerations of dead trees were conducted by the working plan party during 1932; since then their extraction over the whole of the old sandal area in Alagarcoil valley has been undertaken during 1932 and 1933 respectively. Owing to the new sandal area being considerably larger than the old one a balance of dead trees remain unextracted. The following table shows the position as regards dead trees :—

Girth classes.	Working plan enumerations.	Stock of dead trees. Extraction, 1932.	Stock of dead trees. Extraction, 1933.	Balance.
0–0	2,168	73	1,540	555
6–12	2,650	813	1,821	16
12–18	828	329	327	172
18–24	155	43	30	82
24–30	20	4	2	14
Total yield of rough cleaned wood in lbs.	...	14,411 (actual).	34,968 (estimated).	11,785 (estimated).

The estimated balance of 11,785 lbs. or 5·2 tons will be extracted in the first three years of the period of the plan.

The annual yield has been estimated—vide paragraph 432 above—to be 4 tons for the whole area. The average yield for the first three years of the working plan period will therefore be 9·2 tons or 3·06 tons per annum including the balance of dead trees remaining unextracted. For the remaining seven years of the working plan period an average annual yield of 4 tons per annum may be expected.

SECTION 5.—METHOD OF EXECUTING THE FELLINGS.

435. *General.*—Exploitation will be of three kinds :—

(*a*) Regular.
(*b*) Periodical.
(*c*) Occasional.

In all three cases only dead trees and damaged stems or parts of trees containing scented heartwood will be extracted—vide paragraph 431 above :—

(*a*) *Regular extraction.*—This will be limited to the Alagarcoil Sandal Felling Series which has been divided into three blocks; one block will be worked annually the sequence of fellings being laid down in paragraph 441 below.

(*b*) *Periodical extraction.*—This will be undertaken in the Kuttalam sandal area extraction being limited to the area annually tended—vide paragraph 446 below.

(*c*) *Occasional extraction.*—All dead trees whenever and wherever noticed in the sandal areas in Valliyur reserve of Nanguneri Range, and on the Mundanthorai plateau of Ambasamudram Range, will be extracted.

436. *Regulation of working.*—Extraction will be regulated by area irrespective of outturn. The forests are at present quite free from spike, but if it does appear, and it is considered expedient to work more rapidly the territorial Conservator may alter the sequence of coupes or extend the area to be exploited annually, subject to a report being made to the Chief Conservator of Forests. Full reasons for such changes should be recorded in the Control Book.

437. *Agency of fellings.*—The felling and extraction shall be conducted departmentally. There is no objection however to the work of rough cleaning, and final cleaning being done on a contract basis under close departmental supervision, provided that this method is cheaper and at least equally efficient.

438. *Method of extraction.*—Extraction will be regulated solely by the rules contained in the printed official booklet entitled " RULES REGARDING THE SELECTION FELLING CLEANING CLASSIFICATION AND DISPOSAL OF SANDALWOOD, AND THE METHOD OF MAINTAINING DEPOT ACCOUNTS AND OTHER REGISTERS ".

439. *Forest depots.*—Since the quantity to be extracted is comparatively small, and the risk of storing rough cleaned wood in forest depots where it is exposed to fire damage and theft great, forest depots will not be established. All trees uprooted in the course of the day will be rough cleaned and transported to the nearest forest rest-house daily where it will be stored under lock and key in one of the outhouses until a quantity sufficient to form a cartload is obtained; the wood will then be transported to the final cleaning depot at Srivilliputtur.

440. *Main depot.*—All rough cleaned sandal will be final cleaned at the main depot at Srivilliputtur in accordance with the rules referred to in paragraph 438 above. No classification of the final cleaned wood will however be attempted. The final cleaned wood will be packed securely in gunny bags and despatched to Tiruppattur sale depot in accordance with the prevailing practice. Such of the billets however as are required for retail sales in the division—vide paragraph 451 below—will be retained.

441. *Tabular statement of fellings.*—The following table shows the sequence of fellings in the Alagarcoil Sandal Felling Series :—

Year.	Block No.	Area in acres.
1934–35	I	2,045
1935–36	II	1,645
1936–37	III	1,375
1937–38	I	2,045
1938–39	II	1,645
1939–40	III	1,375
1940–41	I	2,045
1941–42	II	1,645
1942–43	III	1,375
1943–44	I	2,045

SECTION 6.—SUBSIDIARY SILVICULTURAL REGULATIONS.

442. *Tending.*—Tending of the sandal crop is a matter of the greatest importance; the more easily accessible portions of the crop, i.e., on either side of the Athithondu Puliyuthu path, have been tended in the past with great benefit to the individual trees. The crop in Block III appears to have been most neglected. The prescription of a regular tending plan is therefore necessary.

443. *Tending cycle.*—It is advantageous that tending be carried out simultaneously with the enumeration and marking of dead trees for extraction, as this would ensure economy in expenditure and also frequent tending of the young crop. The tending cycle will therefore be three years. In the Alagarcoil valley the block under extraction will be tended each year. In the Kuttalam reserve the sandal area has been divided into three blocks. One block will be tended annually, all dead trees found in the course of tending operations being extracted.

444. *Nature of tending.*—Three factors are of importance to the growth of young sandal—lateral shade, overhead light and the presence of suitable host trees. In the case of older trees, 1-foot girth and above, sandal being a strong light demander, as much light as possible should be given in order to assist crown development and consequent diameter increment. The following rules for the guidance of tending officers are laid down :—

(1) No tree or plant which serves or might serve as a host to sandal should be destroyed. When necessary such growth should be coppiced or pollarded.

(2) All climber growth should be cut and poisoned if possible. For a suitable method of poisoning the Provincial Silviculturist should be consulted.

(3) In the case of seedling and sapling growth below 9 feet in height all lateral shade should be preserved, and only overhead light admitted in order to encourage height growth. All cut material should be placed around the sandal sapling or group of saplings both to provide lateral shade and to keep out browsers.

(4) In the case of older trees all overhead shade should be removed.

445. *Costs.*—The cost of tending regard to the stock of sandal should not exceed 1½ annas per acre of sandal-bearing area.

446. *Tabular statement of operations.*—

Year.	Locality.	Block number.	Sandal-bearing areas.
			ACS.
1934–35	Alagarcoil	I	1,500
	Kuttalam	I	272
1935–36	Alagarcoil	II	1,265
	Kuttalam	II	256
1936–37	Alagarcoil	III	1,165
	Kuttalam	III	284
1937–38	Alagarcoil	I	1,500
	Kuttalam	I	272
1938–39	Alagarcoil	II	1,265
	Kuttalam	II	256
1939–40	Alagarcoil	III	1,165
	Kuttalam	III	284
1940–41	Alagarcoil	I	1,500
	Kuttalam	I	272
1941–42	Alagarcoil	II	1,265
	Kuttalam	II	256
1942–43	Alagarcoil	III	1,165
	Kuttalam	III	284
1943–44	Alagarcoil	I	1,500
	Kuttalam	I	272
		Total ..	15,998

447. *Regeneration—(a) Sandal plantations.*—The technique of raising sandal plantations has not been sufficiently developed to warrant their prescription. Moreover, fears are already beginning to be entertained of serious overproduction of sandal in the forests of the Presidency. The natural regeneration of sandal from seed is so good, given adequate protection from fire that the energies of the staff can be more profitably directed to assisting nature than in making plantations. No plantations will therefore be prescribed.

(*b*) *Propagation centres.*—The general object of artificial regeneration of sandal by the method of propagation centres is to ensure its spread over as wide an area as possible. The method of forming such centres is detailed in Messrs. C. C. Wilson's and J. E. M. Mitchell's pamphlet entitled "Notes on the artificial regeneration and tending of sandal" a copy of which has been supplied to all District Forest Officers and Range Officers. Propagation centres will be established only in forest which does not already contain sandal, and which is not included in the Timber cum Fuel or Fuel working circles. Suitable areas are noted in the table below :—

Name of range.	Name of beat.	Locality.
Ambasamudram	Kadayam	Ramanadhi valley.
	Aladiyur	Outside the limits of the Koilteri Timber cum Fuel Felling Series.
Nanguneri	Sengalteri	The Mungilpattikidai valley.

In these beats each beat guard will be entrusted with the work of establishing four propagation centres annually. The selection of the sites for propagation centres, will be done by the Range Officer concerned. The essentials are—

(*a*) the presence of vigorous and healthy trees to act as hosts;

(*b*) sufficient lateral shade; and

(*c*) sufficient moisture in the soil.

Stream banks are therefore particularly recommended.

A clearing 10 feet × 10 feet should be made in the middle of a clump of trees and bushes; the cut material should be piled up evenly over the clearing and burnt in April. The resulting ash should be mixed up with the soil and the little plot fenced adequately against game and cattle. Early in May shallow saucer like depressions 5 inches in diameter and at an espacement of about 3 feet × 3 feet will be made in the plot, and a layer of good seeds 10–15 in number dumped in them. This layer will be covered with damp straw or moist humus. Dhall seed may with advantage be broadcast sown in the area simultaneously in order to provide hosts for the young sandal seedlings. The dumps should be watered twice a week in case there is no rainfall, and after germination has occurred occasional watering will be necessary until either of the monsoons has arrived and no long spell of drought is expected. Periodical aeration of the soil by forking is advisable, but care should be taken that this is done under proper supervision so that the delicate haustorial root attachments of the sandal on its host are not disturbed. Full stocking in the first year will be secured by replacement of causalties if necessary. Survivals will be enumerated in May for two years following the year of formation and the results recorded in the Propagation Centre Journal—vide paragraph 453 below. A 4-inch scale map showing the position of all such centres will also be affixed to the concerned page of this journal.

(*c*) *Strip regeneration.*—With a view to stocking non-sandal areas in the various compartments in Alagarcoil valley, and also to increase the stocking in sparsely stocked areas, vide stock map, line sowing of such areas will be attempted on an experimental scale of 2 acres per annum. From the frequently observed fact in sandal areas that the natural regeneration of this species is particularly abundant along artificially cleared lines, such as fire lines and compartment boundaries, the conclusion may be drawn that similar artificial clearings made in the forest and regenerated artificially would meet with success. The advantages of the method over regular plantations are—

(1) that the hosts are not destroyed; and

(2) that the young sandal is afforded protection from the sun.

Briefly described the method consists in cutting strips 10 feet to 15 feet wide and 1 or 2 chains apart according to the type of forest; the lines should run preferably due North and South through the jungle. The slash should be heaped on the lines and burnt and the soil and ash worked up together. The sandal should be shown as described above, well away from the centre of the strips, preferably early in October before the north-east monsoon, and dhall broadcast sown on the cleared strip simultaneously. It will be necessary to keep out browsers by fencing the ends of the strips with thorns and brushwood.

The sandal seedlings will be tended and casulties replaced if necessary before the succeeding north-east monsoon for two years following the year of formation. During these operations surviving sandal seedlings will be enumerated and the results recorded in the strip regeneration ledger—vide paragraph 30 below.

The results will be reviewed after five years, and the operations extended or discontinued according to whether they have been found successful or otherwise.

(*d*) *Dibbling in bushes.*—It is suggested that in addition to (3), the method of dibbling sandal in the shade of bushes be tried in localities in the Alagarcoil valley where—

(*a*) the sandal is scattered or absent; and

(*b*) the moisture content of the soil appears suitable. This operation can be done by the local subordinates over as large an area as can be conveniently tackled annually.

448. *Seed collection.*—All seed required for regeneration operations will be collected from local seed bearers. Seed from other divisions should on no account be imported owing to the possibility of introducing spike disease with it. This is a matter of great importance and the prescription must be carefully observed.

The fresh ripe fruit should be collected from vigorous well grown trees with thick dark green leaves; the outer skin and pulp from the seed should be removed as soon as possible after collection, by macerating the fruit in water. The seed should be carefully dried in the sun and sown with the minimum of delay. If storage is found necessary, the seed should be stored in air tight tins.

SECTION 7.—OTHER REGULATIONS.

449. *Grazing.*—Grazing of cattle and sheep is not harmful in sandal areas provided the incidence is not excessive and graziers can be persuaded to refrain from setting fire to the forest. Limited grazing tends to keep down too thick a growth of grass and helps to keep the forest open, two desirable requirements for the regeneration and development respectively of sandal. The whole of the working circle with the exception of sandal and fuel regeneration areas (vide paragraphs 447 and 365) will be open to grazing. All areas within the working circle, in which fires occur will be promptly and effectively closed to grazing for a period of three years.

450. *Fire protection.*—The protection of the working circle from fire is of the first importance. The present unsatisfactory stocking in the lowest girth classes is primarily due to inadequate fire protection in the past. In rugged country such as is present in the working circle, fires are difficult to control except by an elaborate system of internal and external fire lines which are far too expensive to maintain. However all the paths and roads in frequent use will be fire traced annually. Prescriptions to this effect are detailed in paragraphs 489–490 under fire protection.

451. *Retail sale of sandal.*—It is necessary to make provision for the retail sale of sandalwood required for bona fide domestic purposes. Large quantities of Australian sandalwood are imported annually into the division—vide paragraph 80, part I above; this wood, although inferior in essential oil content and scent, to the indigenous variety is nevertheless preferred locally to the latter, for domestic purposes, as the billets are beautifully polished and therefore are easier to handle and convert into sandal paste. It is advantageous therefore that sandal put up for retail sale in the division should be similarly polished and made attractive to buyers. The details of these retail sales will be settled by the territorial Conservator in accordance with the practice that is now being established in the Madras Presidency generally. The District Forest Officer will select the number of billets required for retail sales in the division from the stock in the main depot at Srivilliputtur annually, the balance only being sent to Tirupattur sale depot.

452. *Boundaries.*—The artificial boundaries of each sandalwood block will be demarcated by 6 feet wide cleared lines in accordance with the felling series map prior to tending operations (vide paragraph 443 above) being undertaken in it. Thus at the end of the first tending cycle, all the compartments will have their limits demarcated on the ground.

SECTION 8.—CONTROL.

453. *General.*—The following control records are prescribed and the District Forest Officer will be personally responsible for their accurate maintenance :—

(*a*) The Control Book.

(*b*) The Record of Works.

(*c*) Control Journal.

(*d*) Strip Regeneration ledger.

(*e*) Propagation Centre Journal.

(*f*) Control map.

(*a*) *The control book.*—This will be a record of all exploitation carried out annually in the working circle with yields obtained. Any deviation from the working plan prescriptions with the authority for such deviation will be noted in the appropriate column of the control book.

(*b*) *The record of works.*—This will be a record of measures prescribed and undertaken for the regeneration and improvement of the forest. In addition measures suggested in the Working Plan, together with measures neither prescribed nor suggested but carried out will find a place in this record.

(*c*) *Control journal.*—This will be in the form of a bound note book and will contain the personal observations of the District Forest Officer on the growing stock, and its exploitation and regeneration, as laid down in section 50 of the Madras Forest Code. It should also detail the quantities of sandal disposed of in retail sale annually and the agency employed.

(*d*) *Strip regeneration ledger and propagation centre journal.*—These will be records of details of operations carried out under the prescriptions in paragraph 447 (*b*) and (*c*) respectively.

Sample forms of control records (*a*), (*b*), (*d*) *and* (*e*), and sample headings for the control journal are given in Appendices XIX, XX and XXI (*a*), (*b*) and (*c*).

(*e*) *Control map.*—A control map of each block on a scale of 16 inches to 1 mile will be prepared annually and will show :—

(*a*) the area actually exploited;

(*b*) the approximate position of dead trees or groups of trees extracted.

(*c*) the area containing spiked sandal, if any;

(*d*) the area tended;

(*e*) the area regenerated annually by strip sowing or any other method. These maps will be recorded annually in the control journal.

CHAPTER VII.—WORKING PLAN FOR THE GRAZING WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE WORKING CIRCLE AND CHARACTER OF THE VEGETATION.

454. *General constitution.*—The working circle will include all the reserved forests in the division with the exception of specified areas which are or may be closed to grazing for silvicultural or other reasons. Such areas may be divided into the following categories :—

(1) areas permanently closed to grazing under the prescriptions of this plan, and

(2) areas temporarily closed to grazing by executive order of the District Forest Officer in order to allow burnt areas to recover or to safeguard natural and artificial regeneration.

455. *Permanent closure.*—The following areas will be permanently closed to grazing :—

— (1)	Range. (2)	Locality. (3)	Area in acres. (4)
(1) The Evergreen Timber Working Circle.	1 Srivilliputtur	Chittar Felling Series	186
	2 Ambasamudram	Ambasamudram Felling Series ..	2,118
	3 Nanguneri	Sengalteri Felling Series	665
(2) The Clear Felling Working Circle.	1 Ambasamudram	Ambasamudram Felling Series ..	802
(3) Bison sanctuaries ..	1 Nanguneri	Mahendragiri	1,500
		Pechimadankadu	2,500
		Area near Venganayakkan Anicut.	2,500
(4) Important catchment areas situated above the Grazing Working Circle boundary.	1 Srivilliputtur	Srivilliputtur reserved forest ..	18,639
	2 Kuttalam	Kuttalam reserved forest ..	4,354
		Krishnapuram reserved forest ..	2,783
		Kadayanallur reserved forest ..	3,916
		Vasudevanallur reserved forest ..	6,989
	3 Ambasamudram Range ..	Papanasam reserved forest ..	57,022
	4 Nanguneri	Kalakad reserved forest ..	23,268
(5) The Afforestation Working Circle.	1 Nanguneri Range	Valliyur reserved forest ..	717
		Kudiraimozhi Teri reserved forest.	12,849

NOTE.—The areas specified in items (1), (2) and (3) are included in item (4). A description of the boundaries of the Grazing Working Circle is given in Appendix XXXI.

456. *Temporary closure.*—Certain burnt areas will be closed to grazing temporarily—vide paragraph 465 below; in addition all fuel coupes of the timber cum fuel and fuel working circles will be closed to grazing for ten years after felling (vide paragraphs 327 and 365 above). All sandal regeneration areas (vide paragraph 447) will be closed to grazing for a period of ten years after formation; the area thus closed will be comparatively speaking negligible.

457. *Character of the vegetation.*—The greater portion of the working circle consists of deciduous forest of varying density of stocking. In the poorest areas such as the Kunnur Beat of Srivilliputtur range and the Vallanad Reserve of Srivaikuntam range, grass is normally available only for two to three months of the year during the north-east monsoon. Trees that yield leaf fodder are accordingly much lopped in these areas especially by sheep graziers; cattle also browse on young growth of fuel species. In areas which get the benefit of both the north-east and the south-west monsoons, fairly good fodder is normally available from July to the end of February.

The fuel felling series on the outer slopes, on account of their propinquity to villages and the character of the forest, provide the greater portion of the grazing requirements of the population. Above these working circles and below the zone of shola forests are stretches of steep grassland sparsely stocked with deciduous tree growth. The principal grass here is *Andropogon bladii*, a coarse tali grass of poor nutritive value; if burnt the tender shoots produced are palatable to cattle; this fact is known to graziers and is one of the chief causes of incendiarism. Burning on these steep slopes naturally results in further deterioration of the growth and subsequent soil erosion. Freedom from fire on the other hand would eventually induce the natural spread of tree species, and thus incidentally produce in time those grasses of a much higher nutritive value which are usually found in open woodland forest.

The afforestation working circle will continue to be closed to grazing, as the claims of afforestation must for a long time to come be considered paramount to other considerations.

SECTION 2.—BLOCKS AND COMPARTMENTS.

458. *Grazing units.*—The existing division of the grazing working circle into 36 grazing compartments vide paragraph 84, Part I, was justifiable when grazing was regulated under the block system, and the incidence of grazing was capable of being controlled by the issue of only a certain fixed number of grazing permits for each compartment.

Under Chief Conservator of Forest's Proceedings Mis. No. 290, dated 1st June 1932, communicating G.O. No. 595, Development, dated 29th April 1932 and G.O. Mis. No. 802, Development, dated 11th June 1932, the whole division now forms one grazing unit; accordingly a grazing permit is now valid over a whole division. In actual practice however cattle from the villages in one range are rarely, if ever, likely to be taken to another range for grazing, and it will be convenient therefore for control purposes to make the range the unit of grazing, especially as the revenue is collected separately for each range.

The following statement gives details of areas open and closed to grazing in each reserve by ranges:—

Name of reserved forest.	Areas open to grazing.	Areas closed to grazing.	Total area of the reserved forests.
	ACS.	ACS.	ACS.
Srivilliputtur Range.			
Srivilliputtur	25,595	18,639	44,234
Valaikulam and Sappaniparambu	1,569	...	1,569
Total ...	27,164	18,639	45,803
Kuttalam Range.			
Kuttalam	5,450	4,354	9,804
Vadagarai Melpidagai	506	...	506
Kadayanallur	4,460	3,916	8,376
Krishnapuram	2,830	2,783	5,613
Vasudevanallur	20,300	6,989	27,289
Total ...	33,546	18,042	51,588
Ambasamudram Range.			
Papanasam	26,190	57,022	83,212
Nanguneri Range.			
Kalakad	31,983	23,268	55,251
Valliyur	...	717	717
Kolundamalai	1,539	...	1,539
Terkuviravanallur	3,187	...	3,187
Manpothai	1,242	...	1.242
Vallanad	5,087	...	5,087
Kudiramozhi Teri	...	11,372	11,372
Total ...	43,038	35,357	78.395
Grand total ...	1.29.938	1,29,060	2,58,998

SECTION 3.—METHOD OF TREATMENT.

459. *Objects of management.*—The object of management will be :—

(*a*) to provide adequate pasture for cattle in villages adjoining reserves, consistent with the conservation of the forest and with the objects of management of other working circles;

(*b*) to limit the grazing incidence and to produce revenue by imposing a fee for licensing cattle to graze in the forest; and

(*c*) to attempt the improvement of grass and grazing facilities.

460. *Regulation of grazing.*—Grazing will be regulated by the issue of permits subject to the usual conditions which are printed on the back of them. The following domestic animals may be licensed to graze, the existing rates being levied.

	PER HEAD RS.	A.	P.
Sheep	0	4	0
Cows and bulls	0	8	0
Buffaloes	1	0	0
Elephants	10	0	0

Goats will on no account be licensed to graze or admitted into any of the reserves.

Provision of a commission of 5 per cent on grazing revenue collections has been made vide paragraph 575, in case the system of engaging Permit Issuing Officers is revised. Until then the grazing revenue will continue to be collected departmentally.

461. *Grazing year.*—A grazing permit will be valid for only one grazing year—the fasli year—starting from 1st July and extending to the following 30th June.

462. *Penning.*—Penning tends to make the incidence of grazing more even by encouraging graziers to visit the remoter parts of the forest. That the fuel series situated mostly on the outer slopes of the ghauts are overgrazed, requires no elaborate proof; statistics (vide paragraph 87, Part I), show that the incidence varies between 2 and 4 acres per cow unit the lower figure being undoubtedly too high. Penning is therefore eminently desirable and should be encouraged, provided graziers can be prevented from burning the forest.

463. *Regulation of penning.*—The following regulations will be observed :—

(1) No penning will be allowed within half a mile of the bison grazing grounds, namely, Pechimadankadu and around Netterikal and Nadugani in Nanguneri Range; vide Chief Conservator of Forest's Proceedings Mis. No. 177, dated 5th April 1932.

(2) Penning will be restricted to the limits of the grazing working circle as laid down in the working plan maps.

(3) Penning within the limits of the Timber cum Fuel, Fuel and Sandal Working Circles will be prohibited.

(4) No penning fee may, under item 3 of G.O. No. 1126, Development, dated 15th September 1933, be now imposed in view of the fact that penning fees have not been levied in the past. This is, however, inequitable and as soon as the question is reopened penning fees should be fixed, it is suggested, at a rate of Rs. 5 per 100 cattle and Re. 1 for each additional 20 or fraction thereof. This will of course be payable in addition to the usual grazing fee.

(5) Permits for penning will be issued by the District Forest Officer who will satisfy himself, by inspection if necessary, that the locality of the pen does not violate any of the above regulations.

464. *Fodder grass.*—This item shall continue to be leased out for commercial purposes, with the proviso that free cutting and removal on headloads by individuals shall be permitted for bona fide domestic purposes from all permanently closed areas.

465. *Closure of burnt areas.*—Whereas ample provision for grazing is necessary, notwithstanding its evils, burning by graziers, which is injurious both to the trees and the grass, cannot be tolerated and must be suppressed by the strictest measures.

Areas which have to be specially protected are permitted to be closed to grazing under G.O. Mis. No. 1816, Development, dated 25th October 1929. Burnt areas come under this category and they should therefore be closed temporarily, in order to allow them to recover from the damage caused by fire. It is emphasized that such closure is intended primarily as a silvicultural measure.

If therefore a burnt area is extensive enough, and the damage to the growth is severe enough in the opinion of the District Forest Officer, who must be the judge of such matters, a case for immediate closure exists. Some device for effecting the automatic closure of burnt areas of limited extent is therefore desirable. A suitable arrangement would be to empower the District Forest Officer to close on his own initiative burnt areas not exceeding 1,000 acres, subject to report to the Collector for confirmation within ten days. Accordingly it is prescribed that the Collectors be requested to delegate powers in this respect to the District Forest Officer, as has been done in certain other districts and that it should be pointed out to them that the proposal *can do no harm* as the 10-day limit imposed ensures that no actual exclusion of cattle from areas they wish to graze on can take place before the Collector has had time to cancel the District Forest Officer's order if he wishes to do so; for the young green grass that the cattle like cannot grow in a burnt area within the ten days allowed.

The present procedure by which the Collector's *previous* approval is necessary, has, before now, resulted in the " Gilbertian " position that the question of the closure of areas burnt in the hot weather of, say, 1934 is still under discussion in the hot weather of 1935, by which time all the benefit of the burn has been reaped by the incendiaries, and indeed new areas are being busily fired for the approaching grazing season. In the case of every fire the District Forest Officer will consider the circumstances and decide whether closure is necessary or not. If it is as it will be in most cases, he will, if powers have been delegated to him, close the area immediately and submit a report to the Collector within 10 days for confirmation. If powers have not been delegated he will, with the minimum of delay, submit a report with full particulars to the Collector, and ask for sanction for closure of the area for such period as he may consider necessary. The District Forest Officer will however be entitled to close pens where a fire has occured in the vicinity without reference to the Collector and without refunding penning fees.

The essence of all closure is that it must follow a fire swiftly, and must be effectively enforced, or it will not have the desired result.

466. *The annual grazing demand.*—With a view to discovering the maximum number of cattle which are likely to resort to the forests for grazing, the cattle census figures for 1929–30 (the latest census year) were taken for all villages within 5 miles of a reserved forest, with the following results :—

Name of range.	Number of cow units 1929–30.	Number of cow units for which permits were taken in 1929–30.	Percentage of cattle visiting reserves.
Srivilliputtur	32,471	5,666	17·4
Kuttalam	24,865	3,471	13·9
Ambasamudram	57,740	1,963	3·4
Nanguneri	32,456	2,656	8·1
Srivaikuntam	16,795	1,127	6·7

The varying and comparatively small percentage of cattle visiting the reserves in each range is accounted for by—

(1) the existence of alternative grazing grounds such as patta lands, tank-beds, zamindaris, etc. In such lands grazing is either free or regulated by fees. The absence of any restrictions relating to indiscriminate burning, checking of permits, etc., and the greater proximity of these grazing grounds to villages, operate as powerful factors in inducing graziers to prefer them to grazing in the reserves;

(2) the liability of particular reserves or portions of reserves to closure in case of fire; and

(3) the necessity for graziers to accompany their cattle when grazing in the reserves in order to guard them from wild animals and to prevent them from grazing in closed areas.

467. *The annual supply.*—The Timber cum Fuel and Fuel Working Circles have a total area of 61,180 acres. As the 10 youngest coupes are proposed to be closed to grazing $\frac{1}{4}$ of the former and $\frac{1}{3}$ of the latter will not be available. The average area thus closed will amount to about 18,700 acres.

The total area available for grazing below the 1,500 feet contour in the division amounts to 82,300 acres; deducting from this the 18,700 acres referred to above 63,600 acres will remain permanently open to grazing unless any portion of it has to be closed on account of fires as provided for in paragraph 465 above. On the basis of 5 acres per cow unit this will suffice for 12,700 cow units.

The provision for penning under adequate safeguards (vide paragraph 463 above), in that portion of the working circle above the 1,500 feet contour, will result in an increase of revenue, and what is more important a more even distribution of the grazing

incidence. The extent of this increase of revenue cannot be forecasted as it will depend largely, on the extent to which the graziers will co-operate with the department in keeping out fires from the areas in which penning is permitted. Under normally favourable circumstances, that is, in the absence of large fires, which would necessitate closure, it is anticipated that 3,300 additional cattle can be catered for in this manner. The following estimate of the revenue in each range is expected to be attained :—

Name of range.	Number of cow units.	Estimated revenue.
	RS.	RS.
Srivilliputtur	5,500	2,750
Kuttalam	4,000	2,000
Ambasamudram	2,000	1,000
Nanguneri	3,000	1,500
Srivaikuntam	1,500	750
Total ...	16,000	8,000

SECTION 4.—SUBSIDIARY SILVICULTURAL REGULATIONS.

468. *Improvement of grazing grounds.*—The revenue obtained from grazing, which on the basis of an incidence of even 4 acres per cow unit, amounts to 2 annas per acre per annum, does not justify expenditure on the improvement of grazing grounds. The solution of this problem lies either in inducing the people to take on lease for grass farming, forest areas not otherwise under exploitation or to undertake departmentally the propagation of fodder grass species which may be depended upon to spread themselves without artificial assistance. In this division the bulk of the forest suitable for the raising of fodder grass, is already included in the various fuel felling series; the extensive destruction of tree growth on the plains in order to meet the needs of cultivation and the irregular and unsilvicultural working of the majority of the zamindari forests make it imperative in the interests of the future fuel supply that the area under fuel in the Government forests should not be unduly reduced.

469. *Ponam grass farms.*—It is however recommended that wherever local ryots are willing to practise grass farming in areas not included in the Timber or Fuel Working Circles, such areas not exceeding 5 acres to an individual or group of individuals, be leased out to them. The terai portions surrounding Valanad hill in Srivaikuntam Range and Kolundumamalai Hill in Nanguneri Range and the flat portions of Kunnur beat in Srivilliputtur Range are suggested as suitable areas for this experiment. In order to provide shade and also to increase the revenue from minor forest produce the lessee should be induced to plant tamarind trees at an espacement of 40 feet by 40 feet. Although most grass will not grow under the shade of tamarind it will be years before the seedlings of the latter will give sufficient shade to kill out the grass. The grass seed and tamarind seedlings may be supplied to the lessee departmentally. *Pennisetum cenchroides* and *Cynodon dactylon* are recommended as suitable fodder grasses.

470. *Departmental grass farms.*—With the exception of the experimental introduction of grass in the Kudiraimozhi Teri Reserve (vide paragraph 251 above) no attempts to plant fodder gasses departmentally will be made, until experiments which are being conducted in North Coimbatore division have conclusively proved that grass can be effectively and inexpensively raised.

SECTION 5.—OTHER REGULATIONS.

471. *Semi-wild cattle.*—These are present in the Vallanad and Kudiraimozhi Teri Reserves of Nanguneri Range. In the former reserve which is open to grazing their presence not only increases the abnormally high grazing incidence (which was 2·5 acres per cow unit during 1932–33); but also provides the surrounding ryots with facilities for much illicit grazing; for, a large number of domestic cattle, mainly cows, are driven into the reserve by their owners annually during the grazing season, i.e., from about the middle of October to the middle of February, and are allowed to mix with the semi-wild cattle. These domestic cattle owing to their long sojourn in the forest attain a degree of intractability which renders their capture for impounding purposes impracticable. The ryot however waits for the calving season and by capturing the young calves and bringing them away to the village ensures the mothers' return to the village. When the cows thus removed have ceased to give milk they are returned to the reserve and so the vicious system goes on. It is not surprising that under these circumstances the Forest is rapidly deteriorating from overgrazing and that the problem of ridding the Reserve of all semi-wild cattle is urgent in the interest of Forest conservation. Capture

of these pests by Keddah operations has been found expensive, troublesome and ineffective in reducing their numbers, vide paragraph 223, Part I. The only solution would appear to be to destroy them after due notice has been given. In G.O. Mis. No. 881, Development, dated 29th June 1934, however, Government consider that the idea of destroying these pests on an organized basis is repugnant in spite of the damage they are doing to the Reserve. Under the circumstances it is prescribed that the existing staff will attempt to capture and impound as many cattle as possible in the ordinary way. This measure may not mitigate the nuisance to any appreciable extent, as pound fees are rarely paid, the villagers finding it more profitable to disown ownership temporarily and buy back the cattle in public auction for nominal sums. It is therefore suggested that similar measures to those adopted in the Sriharikota Reserve of Nellore District, in connexion with the same problem of semi-wild cattle, be tried here, if the capturing operations again prove a failure. In this connexion reference should be made to Appendix XXXII in which is quoted the relative correspondence and the order passed by Government. In accordance with such a scheme grazing fees, at the rate of 8 annas per cow or bull, would be collected from all cattle-owners residing in any village within 5 miles radius of this Reserve, the number of cattle in each village being that shown in the latest cattle census. For this purpose, the District Forest Officer would enter into an agreement with the respective representative ryots in the form given in Appendix XXXII. The grazing fee would be payable on the 1st of July annually and any arrears would be liable to be recovered with interest at $6\frac{1}{4}$ per cent as arrears of land revenue. Special care would have to be taken by the District Forest Officer at each cattle census to ensure that no domestic cattle were turned into the Reserve to avoid enumeration. It is expected that this procedure would mitigate, if not wholly prevent, the prevailing system under which a large number of domestic cattle are grazed free in the Reserve under the guise of semi-wild cattle. In addition, it would enable the small subordinate staff to concentrate their attention on capturing the real semi wild cattle, and on protection and regeneration operations, as it would release them from the necessity for collecting grazing revenue and maintaining an incessant watch for illicitly grazed cattle. The District Forest Officer would have to address Government and obtain sanction for the proposals outlined above before putting them into force.

In the Kudiraimozhi Teri Reserve, which is permanently closed to grazing, the presence of semi wild cattle has been one of the principal handicaps to the rapid fixation of the moving sand in the Reserve. Constant disturbance of the hard surface crust prevalent in the Reserve by trampling of cattle has converted the crust into a loose condition which renders it very liable to be moved by the strong gales which sweep over the Reserve. Keddah operations are out of the question here as not only is the Reserve so sparsely afforested as to render materials for the Keddah difficult to obtain but the soil is so sandy that stakes driven into it can easily be uprooted by the rush of cattle, thus making any sort of fence impracticable. Here again organized destruction of the cattle would have been the best solution of the problem but is not prescribed as Government is averse to this practice. The District Forest Officer will be empowered to permit capturing by netting under departmental supervision but through the agency of private individuals on condition that no damage to the Forest growth results and that up to 75 per cent of the sale proceeds of all animals caught be delivered to the capturer. A suitable form of agreement will be entered into with prospective capturers with the previous approval of the Territorial Conservator. In addition special parties of subordinates will be organized by the Range Officer, Nanguneri, with a view to capturing such of the semi wild cattle as can be caught. It is suggested that these parties be arranged during the calving season so that at least calves may be caught and the increase of semi-wild cattle in this Reserve thus effectively stopped. All cattle so caught will be sold in public auction by the Range Officer, Nanguneri, and the proceeds credited to Government.

SECTION 6.—CONTROL.

472. *Control records.*—The following control records shall be maintained by the District Forest Officer :—

(*a*) Control book.

(*b*) Control journal.

(*c*) Control map.

(*a*) *Control book.*—This will be a record showing the actual area in each range open to grazing, together with the number and description of cattle licensed to graze annually.

(*b*) *Control journal.*—This will be a record of personal observations made by the District Forest Officer on the effects of grazing, the adequacy of provisions made for grazing, and the suitability or otherwise of the various prescriptions of the

working plan in relation to grazing and penning. Form with sample entries of control record (*a*) and suitable headings for the Control Journal are given in Appendices XXII and XXIII.

(*c*) *Control map.*—A control map on a scale of 1 inch to 1 mile shall be prepared in the District Forest office for each range annually showing areas—

(*a*) permanently closed;
(*b*) temporarily closed;
(*c*) penning sites commonly used; and
(*d*) site of grass farms.

CHAPTER VIII.—WORKING PLAN FOR THE MINOR FOREST PRODUCE WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION AND CHARACTER OF THE VEGETATION.

473. *General.*—The working circle covers the whole of the reserves of the division. The character of the vegetation has been described in earlier portions of the working plan. The main items of the minor forest produce collected are, in alphabetical order, avaram bark, bees wax and honey, cashew nuts, thatch and fodder grass, gallnuts, indukodi (*Acacia intsia*), itakalli (*Ochlandra sp.*), kelakoi (*Carissa carandas*) rattan, stone and gravel, tamarind and the usufruct of palmyras. A detailed list of the item collected is given in paragraph 90 of Part I.

474. *Farms.*—In order to stimulate competition, each range is divided into a varying number of farms, each farm forming a unit of sale. Wherever a particular produce exists in sufficient quantities in a particular farm, this produce is put up for sale separately, e.g., tamarind. The various farms and units of sale are noted in the tabular statement below. The description of the boundaries of farms are given in Appendix XXXI.

Units of sale. (1)	Nature of produce. (2)	Farms number. (3)	Locality. (4)	Remarks. (5)
	Srivilliputtur range—			
1	All minor forest produce except tamarind and usufruct of palmyras.	I	Mudangiar ..	.. Including Mudangiar rest-house compound.
2	Do.	II	Athithondu.	
3	Do.	III	Pudupatti ..	.. Including Pudupatti rest-house compound.
4	Tamarind	I	Mudangiar.	
5	Do.	II	Athithondu.	
6	Do.	III	Pudupatti.	
7	Stone and gravel	III	Do.	.. Outside the limits of the fuel working circles.
8	Usufruct of palmyras—Rengarcoil beat.	..	Rengarcoil.	
9	Usufruct of palmyras—Valaikulam reserve.	..	Valaikulam.	
	Kuttalam range—			
10	All minor forest produce except tamarind, itakalli and rattan.	I	Vasudevanallur reserve.	
11	All minor forest produce except itakalli and rattan.	II	Krishnapuram reserve.	
12	Do.	III	Kadayanallur, Chinnakadu, Vadagarai Kilpidagai and Vadagarai Melpidagai reserve.	
13	Do.	IV	Kuttalam reserve ..	Including Kuttalam rest-house compound.
14	Itakalli and rattan	I	Vasudevanallur reserve.	
15	Do.	II & III	Krishnapuram Kadayanallur and Chin nakadu reserves.	
16	Do.	IV	Vadagarai Kilpidagai reserve.	
17	Do.	VI	Kuttalam reserve.	
18	Tamarind	I	Vasudevanallur reserve.	
19	Avaram bark	..	Unreserves of Sankaranainarkoil.	
20	Do.	..	The whole range.	
	Ambasamudram range—			
21	All minor forest produce except rattan and usufruct of palmyra and coconuts.	I	Papanasam section ..	Including Sivaiselam rest-house compound.
22	Do.	II	Kariar section.	
23	Rattan and itakalli	I	Papanasam section.	
24	Do.	II	Kariar section.	
25	Usufruct of palmyras and coconuts.	I	Papanasam section.	

Units of sale. (1)	Nature of produce. (2)	Farms number. (3)	Locality. (4)	Remarks. (5)
	Nanguneri range—			
26	All minor forest produce excluding rattan and itakalli.	I	Reserves in Ambasamudram taluk.	
27	Do.	II	Vadagarai.	
28	Do.	III	Kalakad	Including Sivanaperi rest-house compound.
29	Do.	IV	Nambikoil.	
30	Do.	V	Parivarisuriyan.	
31	Rattan	..	The whole range.	
32	Itakalli	..	Do.	
33	Stone and gravel	..	Kolundamamalai east slope quarry.	
34	Do.	..	Kolundamamalai north slope quarry.	
35	Honey and wax	..	Valanad reserve ..	Any other minor forest produce for which there is a demand may be included.
36	Screwpine flowers, fruits of mango, cashew, *Ficus sp.* and punnai (*Calophyllum inophyllum*).	..	Kudiraimozhi Teri reserve.	

SECTION 2.—METHOD OF TREATMENT.

475. *Agency of exploitation.*—The right to collect minor forest produce will be leased out annually, each of the above mentioned items being sold in public auction. Exploitation will be through the agency of contractors; but in the case of produce such as dammar and tamarind which can be easily collected and stored, the District Forest Officer will be empowered to order departmental collection in the event of prices obtained for a particular farm being unsatisfactory as compared with previous years prices and the current years expectation of the crop.

Deer horns will be collected departmentally, care being taken that the forest is not burnt for this purpose by the coolies employed.

476. *Auction sales.*—Minor forest produce will continue to be sold by the District Forest Officer in auction.

In case the prices obtained at the sales are unsatisfactory it is suggested that tenders may be called for by the District Forest Officer; if this is done, it should be done with the minimum of delay and tenders received submitted to the Territorial Conservator with the District Forest Officer's recommendations.

All auction sales will be held between the 15th of May and the 15th of June so that there may be sufficient time to call for tenders for units for which unsatisfactory prices are obtained.

477. *Period of lease.* All sale units will be leased out for the fasli year from 1st of July to the 30th of the succeeding June.

478. *Supply and demand.*—Practically all the minor forest produce collected is absorbed locally. Tamarind from the Srivilliputtur Range is exported to Madura. The average annual revenue for the 10-year period ending 1933–34 was Rs. 8,889. Owing to the prevailing depression which started in 1931–32, the average revenue for the three years ending 1934–35 was only Rs. 6,450. Now the depression shows signs of lifting, though the process will probably be gradual. The revenue from this working circle is therefore expected to average Rs. 7,500 during the period of the plan.

SECTION 3.—SUBSIDIARY SILVICULTURAL REGULATIONS.

479. *Tamarind.*—With a view to increasing the stock of tamarind trees in the reserves and also to provide shade, it is suggested that the beat subordinates should annually plant at least a 100 tamarind plants on either side of all main roads, cart-tracks and birdle-paths passing through deciduous forest occurring in their beats. It is recommended that stump plants about a year old be used for the purpose, and that each plant be protected from browsing by a thorn fence. The planting should be done about 40 feet apart along the length of the road or path, and ample room should be left for the future widening of the road or path where necessary, localities obviously unsuitable for tamarind such as rocky ground will not be planted.

480. *Dammar.*—In view of the large stock of *Canarium strictum* trees in the evergreen forests of the division it is desirable that some effort be made to utilize this tree the timber of which is useless. Under the old method of extraction a hole about 4 inches deep and about 4 inches in diameter was made in the tree and the exuding resin ignited. This had the effect of inducing a large flow of resin which flowed down the tree and was subsequently collected. This method was stopped probably because of the danger from fire and the likelihood of the tree dying under repetitions of this drastic treatment. At

present extraction is limited to the collection of dammar exuding from broken branches or gashes made in the tree trunk. It is, therefore, prescribed that the coolies of the minor forest produce contractor be permitted to collect dammar by the old method for a period of three years and that accurate statistics of the increase of yield in relation to the increase in revenue, together with observations of the effect on the tree and the danger to the forest from fire be recorded in the Control Journal. If the results are satisfactory this method of collection will continue to be permitted, with the previous sanction of the Territorial Conservator.

481. *Gallnuts.*—It is also desirable to increase the stocking of *Terminalia chebula* trees in suitable areas in the forest. These trees are widely scattered in small gregarious patches principally over type IV forest—vide paragraph 45, Part I—between elevations of 2,000 feet and 3,500 feet. This naturally increases the cost of collection which according to local contractors amounts to about Rs. 70 per ton of dry nuts. Unless therefore the market value is higher than this, collection is not done to any appreciable extent; this accounts for the fact that no bids were made during the 1931 and 1932 minor forest produce auction sales when the right to collect gallnuts in the various ranges was sold separately. This produce has therefore recently been included with other items of minor forest produce.

With a view to increasing the stocking of *Terminalia chebula* and thereby reducing the costs of collection in the future, it is prescribed that beat guards of the beats mentioned below be encouraged by a system of rewards to plant as many seedlings or stump plants of this species as possible in suitable localities, about 2,500 feet elevation, close to the paths mentioned below. Rough fencing to protect them from browsing will probably be necessary.

Name of range.	Name of beat.	Bridle-path.
Srivilliputtur	Mudaliaruthu	Puliyuthu-Mudaliaruthu bridle-path and its extension to the Chittar.
Kuttalam	Mathalamparai	Path leading to Varaiadumottai.
Ambasamudram	Kadayam	Ramanadhi valley upper slopes-path.
Nanguneri	Sengalteri	Muthalaruppan-Sengalteri bridle-path.

The amount of the reward will be decided by the Territorial Conservator. The District Forest Officer will keep in touch with the District Forest Officer, North Coimbatore, where a similar experiment is being made and with the Provincial Silviculturist, and ascertain from them the most successful method of raising *Terminalia chebula.*

According to the Forest Utilization Officer a 2-feet girth tree yields 82 lbs. while a 4-feet girth tree gives 246 to 328 lbs. of gallnuts, on an average, annually, in North Coimbatore and Salem divisions. Good seed years nearly double this yield. On a conservative basis therefore a tree could be expected to yield 100 lbs. a year from the age of about 30 to 60 years and 200 lbs. a year annually thereafter until its death; probably at 100 years. Assuming a profit of 2 pies a pound, each tree would yield an annual income of Re. 1 between the 30th and 60th years and Rs. 2 thereafter. The introduction of this species artificially and inexpensively is thus justified.

SECTION 4.—CONTROL.

482. *Control Records.*—The District Forest Officer will be responsible for the accurate maintenance of the following control records :—

(*a*) Control book.
(*b*) Record of works.
(*c*) Control journal.

(*a*) *Control book.*—This will be a record of the various items leased out annually with prices obtained; full details of the kinds and quantities of minor forest produce collected according to contractor's accounts will also be recorded.

(*b*) *Record of works.*—This will be a record of all operations carried out annually in the working circle.

Forms with sample entries of control records (*a*) and (*b*) are given in Appendices XXIV and XXV.

(*c*) *Control Journal.*—This record will contain the personal observations of the District Forest Officer and should include remarks on the following points :—

(1) The advisability of extending or reducing the size of the various sale units.
(2) The period of the year during which various items of minor forest produce are available for collection in various localities.
(3) The cost of collection of the more important items of minor forest produce.
(4) The prevailing market rate for such items annually.
(5) Notes on the identification of various kinds of minor forest produce in demand.
(6) Suggestions for increasing the yield from any particular produce with results of experiments carried out in this direction.

CHAPTER IX.—MISCELLANEOUS REGULATIONS COMMON TO ALL WORKING CIRCLES.

SECTION 1.—FIRE PROTECTION.

483. *General.*—The protection of the reserves from fire is of paramount importance as to this destructive agent can be attributed the deterioration of tree growth and the progressive conversion of woodland forest into poor grassland. In this division most of the reserves are situated in rugged and mountainous country; for a greater portion of the year strong westerly gales sweep across the ghats and where the south-west monsoon is feeble, a prolonged dry season, accentuates the danger from fire. The protection of the catchment areas of the various streams and rivers on which the extensive irrigation on the plains depends, and the amelioration of the intensity of floods, can only be effected by assisting nature in gradually clothing these areas with tree growth. This can only be accomplished by continued protection from fires.

484. *Possible measures.*—The following measures will now be considered :—

(*a*) Indirect measures, involving no expenditure and aiming at the removal of the temptation and the opportunity for incendiarism.

(*b*) Direct measures involving expenditure.

(*c*) Fire fighting measures for extinguishing or localizing fires immediately they have occurred.

485. (*a*) *Indirect measures*—(*i*) *Fires caused by graziers.*—These will probably be reduced by the closure of burnt areas to grazing which is necessary in the interests of regeneration and the recovery of the forest. The resulting loss of grazing on the young grass for the sake of which the grazier sets fire to the forest will discourage him from incendiarism. The procedure has been detailed in paragraph 465 of the working plan for the Grazing Working Circle.

(*ii*) *Fires caused by minor forest produce contractor's coolies.*—These are a fruitful source of danger and the only method of stopping them would seem to be either to prohibit collection of minor forest produce altogether, which would result in loss of revenue or else to collect it departmentally under strict control, which would be expensive. The latter method is being prescribed in other districts, and the result must be watched and if it is satisfactory it should be introduced here also. In the meantime contractors must be repeatedly warned that if fires continue sales of minor forest produce will cease, and they must be urged to exercise greater control over their coolies. All subordinates must exercise particular vigilance during the period of collection in order to prevent fires and arrest incendiaries.

(*iii*) *Shooting.*—Shooting during the dry weather especially with muzzle loading guns is also a probable cause of fires. A close season coincident with the period during which the incidence of fires is greatest might have been a good remedy but for the fact that the damage is done principally by poachers, and not by regular licence holders who are equipped with more modern arms. The need for special vigilance on the part of the staff against poachers is emphasized.

486. *Direct methods.*—These consist of early burning and fire line clearing both of which are expensive and have serious limitations. There is much to be said in favour of the system of early burning provided the operations are carried out precisely at the right time, so that inflammable material is destroyed while desirable regeneration and woody undergrowth is not harmed. In practice, however, such results cannot be obtained with any degree of certainty or regularity over adequate areas without a larger and more intelligent subordinate establishment than is available. The period during which it is safe and possible to carry out early burning is short and variable; when large areas are tackled, the burn is either so incomplete as to afford little or no protection, or else it is so fierce that it tends to become a departmental act of incendiarism, thus defeating its own object. On the other hand the old system of fire protection practised in the division, which aimed at the complete protection of vast areas of the forest by means of internal and external fire lines was expensive and unnecessary in parts, and failed to produce the immunity from fire which was its sole justification. The only effective fire insurance rests in securing of the good will and active co-operation of the people and it is therefore of the greatest importance that the District Forest Officer should be in close touch with and readily accessible to them.

487. *Policy.*—The general policy regarding fire protection in the division and the measures prescribed to give effect to it are based on the following considerations :—

(1) The most serious sources of danger from devastating fires are the Zamindari and State forests and complete exclusion of fire from these sources must be secured.

(2) Fires originating within our own reserves are inevitable from time to time.

The amount of damage done by them can be greatly limited by reasonable expenditure on—

(a) the fire tracing of all frequented roads and paths annually;
(b) the maintenance of certain important interior fire lines enumerated below (vide paragraph 490); and
(c) the maintenance of a temporary staff of fire patrols in each range to aid the subordinate staff in extinguishing fires and arresting incendiaries. Definite prescriptions designed to give effect to the policy outlined above are detailed below.

488. *State and zamindari boundaries.*—A permanent guide line in the form of an ungraded inspection path, 10 feet wide, will be constructed at an approximate distance of 60 feet from the common frontier between Government forest and the Zamindari or State forests in the places mentioned below; at the time of construction all grass roots on the line should be uprooted. Each year in January this guide line will be roughly recleared and at the earliest possible date, that is, as soon as the grass between the line and the frontier is dry enough, it will be burnt.

Serial number.	Name of fire lines.	Length. M. F.	Width. FEET.	Average annual rate per mile. RS.	Cost of maintenance. RS.
	Srivilliputtur.				
1	Gundamanaickanur boundary line as marked on 4 inches scale map	1 0	60	12	12
2	Sethur boundary line from Pillar No. 1 to shola above Galipodimottai	2 6	60	12	33
	Kuttalam.				
3	Tirumalainaicken Pudukudi boundary	3 4	60	12	42
4	Boundary between Chockampatti Zamin and Krishnapuram Reserve	3 2	60	12	39
5	Northern boundary between Vairavankulam Zamindari and Krishnapuram Reserve	2 4	60	12	30
6	Southern boundary between Vairavankulam Zamin and Kadayanallur Reserve	2 4	60	12	30
7	Boundary between Vadagarai Kilpidagai Reserve and Vellakalteri State Reserve				
8	Western boundary of Vadagarai Melpidagai Reserve.	3 0	60	12	36
9	Western boundary between Kuttalam Reserve and Travancore State Forest				
	Ambasamudram.				
10	Singampatti Zamin boundary in Aladiyar beat				
11	Kattalamalai Estate west boundary				
	Nanguneri.				
12	Singampatti Zamin boundary from Vandal Odai to Panjanthangimottai	3 0	60	12	36
13	Travancore State boundary from peak above Nadugani to Mahendragiri shola	1 2	60	12	15
14	Boundary between Travancore State Forest and Parivarisuriyan Reserve	3 0	60	12	36
	Total ...	37 4			450

489. *Roads and paths.*—The necessity for fire tracing frequented roads and paths in order to prevent damage by fire from the carelessness of wayfarers is emphasized. All such roads and paths should not be fire traced as a matter of routine; the District Forest Officer will satisfy himself before he prepares his fire protection estimates as to whether fire tracing the whole or any portion of the roads or paths enumerated below is essential and obtain the prior sanction of the Territorial Conservator for such deviations as may be found necessary from the prescriptions.

In the case of roads, 10 feet wide, guide lines will be cut on either side beyond the side drains, and all grass and shrubby growth cut and piled on the edge of the road; as soon as the cut material is dry enough it should be burnt, care being taken that no inflammable material is left unconsumed and that the fire does not escape into the forest.

With paths, guide lines 10 feet wide, allowing 6 feet width for the path, will be cleared on either side and the cut material piled on either side of the edge of the path and burnt as above.

It is essential that all operations be conducted under the personal supervision of an officer not below the rank of Forester and that all burning operations are completed before

the 15th of February. The following is a list of roads and paths in the various ranges which should be fire traced :—

Serial number.	Road or path.	Length. M. F.	Rate per mile. RS.	Estimated cost. RS. A. P.
	Srivilliputtur range.			
1	Athithondu Puliyuthu path	4 2	6	25 8 0
2	Virusadi Mudaliaruthu path	1 4	6	9 0 0
3	Mudaliaruthu Chittar path	6 4	6	39 0 0
4	Gundamanaickanur bridle path from Reserve line to Travancore Frontier	4 0	6	24 0 0
	Kuttalam range.			
5	Shenbagadevi path	4 3	6	26 4 0
6	Tekkumalai path	2 3	6	14 4 0
7	Vallam path	1 4	6	9 0 0
8	Krishnapuram valley path	4 6	6	28 8 0
9	Kottamalai valley path	3 0	6	18 0 0
	Ambasamudram range.			
10	Papanasam Ghat road	9 4	6	57 0 0 *
11	Pechiammankoil Budatarkoil road	1 3	6	8 4 0
12	Mundanthorai Kodamady road	6 0	6	36 0 0
	Nanguneri range.			
13	Sengalteri Mudalaruppan path	3 7	6	23 4 0
14	Kopparai road	2 4	6	15 0 0
15	Manpothai Tirukurangudi path	6 0	6	36 0 0
16	Nadugani combined road and path	4 0	6	24 0 0
	Total ...	65 4		393 0 0

* *Remarks.*—Eight and a half miles to Kariar and one mile from Kattalamalai estate boundary towards Kannikatty.

Note.—Only the extent of these roads and paths passing through deciduous forest or grassy areas need be fire traced.

490. *Interior fire lines.*—The maintenance of the following important interior fire lines with the object of protecting important catchment areas, Sandal forest, etc., is prescribed. Two guide lines, 10 feet wide, will be cut on either side of a central belt, 30 feet wide. The cut material will be heaped on the centre line and burnt before the 15th of February :—

Serial number.	Fire line.	Length. M. F.	Cost per mile. RS.	Total cost. RS.	Remarks.
	Srivilliputtur range.				
1	Virusadi Chockampatti line	2 0	12	24	Protection of Sandal Working Circle.
2	Muriappanjamottai to Cairn No. 182 ...	4 4	12	54	Do.
3	Muriappanjamottai to Kavaranemottai	2 0	12	24	Do.
4	Kavaranemottai to Anaikaravaram-mottai	4 6	12	57	Protection of Chittar shola.
	Nanguneri range.				
5	Panchanthangimottai Karumandiamman shola ridge	4 2	12	51	Protection of Manimutar basin.
	Total ...	17 4		210	

491. *Fire patrols.*—Fire patrols on the following scale will be continued to be employed to assist the local subordinate staff in extinguishing fires and apprehending incendiaries. The period of their employment will naturally vary from year to year according to the intensity and distribution of the annual rainfall. It is prescribed therefore that they will be employed for the minimum period annually consistent with the adequate protection of the reserves from the risk of fires :—

Name of section or reserve.	Number of fire patrols.	Approximate period.	Total cost. RS.
Srivilliputtur range.			
Pudupatti	1	4 months.	40
Athithondu	1	Do.	40
Mudangiar	2	Do.	80
Kuttalam range.			
Vasudevanallur reserve forest ...	2	2 months.	32
Krishnapuram reserve forest ...	1	Do.	16
Kadayanallur reserve forest ...	2	Do.	32
Ambasamudram range.			
Kadayam	2	2 months	40
Sivaselam	1	Do.	20
Nanguneri range.			
Terkuviravanallur	1	2 months	20
Kalakad	1	Do.	20
Tirukurangudi	1	Do.	20
Parivarisuriyan	1	Do.	20

492. *Fire fighting.*—As soon as a fire is noticed, no matter what the time, the forest-guard and watcher will collect village officials and contractor's coolies from the nearest village and proceed to the spot and extinguish it by beating it out with branches or throwing earth, or counterfiring if necessary. An investigation into the cause of every fire should be made in every case, and if it is due to incendiarism no pains should be spared to detect and convict the offender. It is recommended that forest subordinates who have detected such offenders and secured their conviction in a court of law be given a monetary reward as an encouragement. The amount of such reward will be decided by the Territorial Conservator.

493. *Expenditure.*—The total cost of fire protection in the division is detailed below :—

	RS.
(1) External fire lines	450
(2) Internal fire lines	603
(3) Fire patrols	380
Total ...	1,433 or 1,500

The costs of clearing and burning external fire lines should be shared on a 50 per cent basis, with the respective Zamin and State administrations concerned. Many of the Zamindars have professed their willingness to contribute either cash or labour and the District Forest Officer will address them with a view to settling the amount of the contribution on a permanent basis. The Travancore Darbar have agreed to contribute half the cost of clearing frontier lines provided the estimates are sent to them in advance and the time of execution of the work is communicated to them in advance—vide paragraph 33, Part I. This should be done by the District Forest Officer.

The annual estimates for fire protection for each range will be submitted on the 1st of August, the close of the fire season for all practical purposes, and will be accompanied by a map of the Range on a scale of 1 inch to 1 mile showing the disposition of all external and internal fire lines, and roads proposed to be fire traced. In addition the area for the protection of which each fire patrol is employed will be indicated. The District Forest Officer before sanctioning the estimates will review the effectiveness or otherwise of the measures adopted in the previous year, and the extent to which the external or internal fire lines burnt and the fire patrols engaged, have been effective in keeping out fires or reducing the area burnt. Each year's estimates will summarise the results of the past year's operations and state the number of fires and the aggregate area burnt in each Range for that year, the influence of climatic factors such as excessive drought, etc., being suitably commented upon.

494. *Control.*—The following control records will be maintained by the District Forest Officer :—

(*a*) Fire Control Journal.
(*b*) Fire maps.

(*a*) *Fire Control Journal.*—A bound note book shall be maintained in the District Forest Office; it will contain complete information on the following points :—

(i) Areas closed to grazing annually on account of fire.
(ii) Name and length of fire lines burnt with costs.
(iii) The incidence of fire in each range in the form of a tabular statement showing—
  (*a*) total area of range;
  (*b*) date of fires;
  (*c*) area burnt;
  (*d*) probable cause of fire; and
  (*e*) percentage of area burnt to total area protected.
(iv) Observation of the District Forest Officer on the superfluity, adequacy or insufficiency of the fire protection measures prescribed with reasons.

(*b*) *Fire maps.*—These will be on a scale of 1 inch to 1 mile for each range. Every fire will be marked to scale on the maps, serial numbers being given to them in chronological order. One set of fire maps will be used for five successive years, fires of each year being distinguished. The correct maintenance of these maps shall be a point for special scrutiny by the Territorial Conservator during his inspection of the District Forest Office.

SECTION 2.—ROADS AND BRIDGES.

495. *General.*—All roads and bridges whether used or not must be kept in a state of repair by the maintenance of a good system of drainage which is invariably an economy. The annual repairs to metalled and fair weather roads should aim not only at a progressive improvement of the surface but also at a gradual extension of the width; all blind corners and hair pin bends on the Papanasam Ghat road should be gradually widened, by blasting where necessary in the course of annual repairs. The existing roads and paths in the division are divided into two classes—

(*a*) those requiring annual repairs; and
(*b*) those requiring occasional repairs.

496. *Annual repairs.*—The following roads and bridle-paths will be annually repaired throughout their whole length. Repairs to unmetalled roads will consist in filling in ruts, repairing damaged culverts and retaining walls, and rectifying defective drainage. Repairs to bridle-paths will be restricted to the maintenance of an adequate drainage system and the repair of broken down revetment walls, culverts, and landslips :—

Serial number.	Road or path.	Length.		Average annual estimated cost of repairs.	Remarks.
	Srivilliputtur range.				
1	Athithondu Puliyuthu path	4	2	45	
2	Virusadi Thalamalaiyankoil path	6	1	60	
3	Virusadi Mudaliaruthu path	1	4	15	
	Kuttalam range.				
4	Shenbagadevi path	2	1	25	
5	Tekkumalai path	2	3	25	
6	Kottanteri road (unmetalled)	3	3	60	
7	Five Falls road (unmetalled)	2	4	150	
8	Puckle's path	3	4	30	
	Ambasamudram range.				
9	Kariar Karuthalaipodai road (unmetalled).	3	0	60	
10	Kannikatty Kalivelipil path and road combined	3	4	50	
11	Mulagajam Taravittanparai road (unmetalled)	2	5	50	
12	Kannikatty to Martin's Hut	6	3	70	
13	Pechiammankoil to Kuduvarai road (unmetalled)	5	7	120	
14	Mundanthorai Kodamady road	6	0	120	
15	Kodamady to Knapp's Hut	7	5	130	Cart-track for 6 miles 6 furlongs and path for 7 furlongs.
16	Knapp's Hut to Wood's Hut	2	3	25	
17	Wood's Hut to Cox's Hut	10	0	70	
18	Cox's Hut to Kuduvarai	7	0	70	
19	Papanasam Mundanthorai road (metalled)	4	0	1,000	
20	Mundanthorai Kannikatty road (unmetalled)	10	4	630	
	Nanguneri range.				
21	Sivanaperi Mudalaruppan road (unmetalled)	4	5	270	
22	Mudalaruppan Sengalteri path	3	7	40	
23	Sengalteri Netterikal path	6	6	70	
24	Kalakad Sivanaperi road (metalled) ...	1	0	150	
25	Kopparai cart-track and path	3	4	210	Cart-track for 2 miles 4 furlongs and path for 1 mile.
26	Vadagarai Arasapathu extension road ...	5	2	100	
27	Nadugani cart-track and path	5	5	160	Cart-track for 1 mile 4 furlongs.
28	Netterikal Tirukurangudi path up to reserve line	7	0	70	
	Total ...	132	2	3,875	

497. *Occasional repairs.*—All other existing roads and bridle-paths enumerated in paragraph 233 will be maintained in a state of repair by the respective beat subordinates. All that is necessary is to keep the drainage system clear, remove obstructions and repair

damaged culverts and retaining walls where necessary. In case damage such as land-slips, etc., occurs to any of these communications and consequent repairs cannot be undertaken by the subordinates unaided, the District Forest Officer, subject to a report being made to the Territorial Conservator, will sanction the requisite expenditure necessary. A sum of Rs. 325 will be allotted annually for such unforeseen repairs.

498. *New constructions.*—(1) Stone causeways will be constructed across the Serviar and Kariar rivers at Mundanthorai and Kariar, respectively, for reasons set down in paragraph 102, Part I. The Forest Engineer has prepared estimate for both projects totalling approximately Rs. 10,000. A contribution of Rs. 4,875 being half the amount of the actual estimates for the construction of causeways across the Serviar at Mundanthorai and across the Kariar at Kariar has now been recovered from the proprietor of the Kattalamalai Estate.

(2) The possibility of converting the existing bridle-path from Mudalaruppan to Sengalteri will be investigated and if this can be done at a reasonable cost, the conversion will be effected, as this project would facilitate extraction of timber from the Sengalteri Evergreen Timber Felling Series, besides making Sengalteri, a healthy hill station, more accessible.

(3) In the event of departmental extraction of the coupes of the Evergreen Working Circle being attempted, short lengths of feeder cart-tracts will be necessary to reduce the cost of manhandling. These will be constructed when and where necessary if the District Forest Officer considers them financially justifiable.

SECTION 3.—BUILDINGS.

499. *Buildings.*—A list of buildings is given in paragraph 234 above. All buildings shall be kept in a state of repair. The surroundings of all rest houses, inspection sheds and subordinates quarters shall be kept clear of undergrowth to a radius of 100 feet around the building as an anti-malarial measure (vide Chief Conservator's Proceedings, L. Dis. No. 6154/29, dated 9th August 1929); in addition, it is prescribed that every building situated within the reserve be adequately protected against fire by clearing a 12 feet wide strip around its compound, of all undergrowth, and burning the cut material early in February. The burnt strip should be kept clear of inflammable material by the local beat subordinates.

A minimum scale of furniture for all rest houses should be standardized by the District Forest Officer in consultation with the Collector and Territorial Conservator and deficiencies in the existing supply, supplemented. The principle should be to provide for as many officers as there are sets of rooms in each bungalow, on a scale which will obviate the necessity for carrying furniture such as tables and chairs. This will not only increase the comfort of touring officers but also result in a diminution of the expenditure under contingencies.

Sanitary arrangements in all the rest houses except Sivanaperi and Kuttalam are primitive. The building of pit latrines in all the other forest rest house compounds within a period of three years is prescribed, the rest houses most frequently visited being taken up first.

500. *New constructions.*—(i) An inspection shed, at an expenditure not exceeding Rs. 500, should be constructed in the reserve, within three years, in the Ammankoil valley in Srivilliputtur Range in order to facilitate inspection and supervision of work in the Ayyanarcoil Timber cum Fuel Working Circle. In the choice of a site the District Forest Officer will be guided by its accessibility and the availability of a perennial water-supply.

(ii) *Motor car sheds.*—All bungalows accessible to motor traffic should be supplied with motor garages. The car has definitely displaced the horse as a means of transport and it is but fair that cars should be treated with the same consideration as horses were in the past, and not parked under a tree and left exposed to the sun and rain. The existing stables at Pudupatti and Mudangiar in Srivilliputtur Range, Sivaisalcm in Ambasamudram Range, and Sivanaperi in Nanguneri Range will be converted into motor garages. In addition motor garages will be constructed at Athithondu in Srivilliputtur Range, and Nazareth in Nanguneri Range.

501. *Water-supply.*—No new wells are contemplated in the division. The existing wells—vide paragraph 234 above—will continue to be maintained and cleaned annually.

SECTION 4.—BOUNDARIES.

502. *State boundaries.*—The common water-shed boundary between Travancore State and Government reserve is not required to be either inspected or cleared—vide paragraph 33, Part I.

503. *Other reserve boundaries.*—The common boundary between the revenue survey limits on the plains and the Reserved Forests shall be kept free of all growth to a width of at least 15 feet by the respective beat subordinates. All changes in the boundary from year to year will be marked in the record copy maintained in the District Forest Office as soon as they have been sanctioned by competent authority.

SECTION 5.—RAIN GAUGES.

504. *Rain gauges.*—The correct maintenance of rain gauge statistics is of great importance. It is prescribed therefore that all gauge readings shall be measured by an officer not below the rank of Forester. The Range Officer will submit a certificate to the District Forest Officer annually that all foresters authorized by him to measure rainfall are thoroughly conversant with the method of reading and recording both single bottle and differential rain gauges. Rain gauge readings will be taken at intervals of a week during the monsoons, i.e. May to July and October to January and at monthly intervals during dry weather. Monthly statements of all rain gauges in their jurisdiction, with dates of readings will be submitted to the District Forest Officer by all Range Officers so as to reach the former by the 15th of the succeeding month.

The gauge at Kalivelipjl will be shifted to Kariar. The gauge at Taravittanparai in Ambasamudram Range, will be shifted to Sivanaperi rest house compound. New rain gauges will be installed, one mid-way up the Kodamadi Ar Valley in Nanguneri Range, and the other at Nazareth rest house in the Nanguneri Range. Reasons for these prescriptions are detailed in paragraph 22, Part I.

SECTION 6.—STORES, TOOLS AND PLANT.

505. *General.*—An average annual expenditure of about Rs. 660 has been incurred on stores, tools and plant during the decennium ending 1932–33. The principal item of expenditure was the maintenance of the ferry boat at Mundanthorai. The ferry boat originally purchased in 1922–23 was renewed in 1930–31 and partially replaced during 1932–33 owing to damage by floods. It is prescribed that steps be taken to moor the boat in a bay on the right bank of the Serviar and also to bind it to some strong tree by iron chains when it is not in actual use especially during the monsoon. If the boat is thus preserved from flood damage an average expenditure of Rs. 500 a year should be ample for all requirements.

SECTION 7.—IMPROVEMENT OF WATER-SUPPLY.

506. *Water-supply.*—The water-supply in the camps on the ghats is adequate normally; the spring at Mudaliaruthu in Srivilliputtur Range is reported to be dry for short intervals during the hot weather; with improved fire protection it is expected that this defect will be gradually rectified; this camp is not important enough to justify the heavy expenditure that would be necessary for a pipe line from the Chittar.

The necessity of a good water-supply both for local subordinates and touring officers is emphasized. It is recommended therefore that in all rest houses on the plains, the wells be covered and pumps installed in them; the district board should be addressed through the Collector for a contribution.

SECTION 8.—REGISTER OF DEVIATIONS.

507. A register of deviations from the prescriptions of the working plan shall be maintained in the following form :—

Year.	Working Circle.	Prescription.	Nature of deviation.	Reasons for deviation.	Remarks on any possible action to remedy the deviation.	Number and date of order sanctioning the deviation.
(1)	(2)	(3)	(4)	(5)	(6)	(7)

CHAPTER X.—WORKING PLAN FOR THE AFFORESTATION WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE WORKING CIRCLE AND CHARACTER OF THE VEGETATION.

508. *Constitution.*—The working circle covers the whole of Kudiraimozhi Teri Reserve of 11,371·77 acres hereinafter referred to as the ' Teri '. A block of 1,952 acres on the western side of the Teri which was disreserved in 1925 has been recently proposed for reservation once more. The portion of this block which is ultimately notified under section 16 of the Madras Forest Act as reserved forest will be included under this working circle.

509. *Division into blocks.*—The whole reserve is at present divided into eight so called ' series '. This terminology is apt to convey the impression that each ' series ' is a felling series; in actual practice however no exploitation is done. In future therefore the term ' block ' will be used when referring to the old ' series '. The names and boundaries of the various blocks have been in existence for a long period and will not therefore be changed. Each block is divided into a varying number of compartments. The following table gives a list of blocks with their areas and the number of compartments into which they are divided; the position of the blocks is shown on the 4″ to 1 mile scale and management maps.

Block number.	Name of block.	Area in acres.	Number of compartments.	Remarks.
I	Semmarikulam	1,285·00	4	Compartments 1, 2, 5, 8, 9 disreserved in 1925.
II	Nazareth	449·00	3	Compartments 1 and 4 disreserved in 1925.
III	Kachinavilai	1,803·00	6	
IV	O'neill	1,003·00	10	
V	Teri	4,854·57	17	In 2 blocks; only the western block is divided into compartments.
VI	O'neill extension	1,260·00	10	
VII	Lushington	525·00	5	
VIII	Kanam	191·20	3	Experimental plots.

510. *Character of the vegetation.*—There is marked variation in the character of the vegetation in each block according to whether the area is unreclaimed, partially or wholly reclaimed; the subject will accordingly be dealt with by blocks.

(*a*) *Semmarikulam block.*—This is practically reclaimed land and is well stocked with palmyras, *Dodonea viscosa, Acacia planifrons, Morinda tinctoria* and *Azadirachta indica.* Compartments 1, 2, 5, 8 and 9 which were disreserved in 1925, had much of the fuel growth on them cut and sold prior to disreservation.

(*b*) *Nazareth block.*—Although the whole of this was planted up with palmyras in the past, a good proportion of the area has still a crust typical of windswept areas; that it still functions as a sand supply area to the teri block lying to the east and north-east of it is quite apparent. The growth of palmyras here is very slow, the vadali stage being reached only after 10 years. Besides vitality of the young *vadalis* is greatly reduced by their being leased out for fibre extraction and cutting of leaves. The process of extraction of the fibre involves the exposure of the tender surface of the growing apex of the tree, thus rendering it particularly liable to attack by the palmyra beetle *Oryctes rhinoceros.* Besides palmyra the area is stocked with *Dodonea viscosa, Acacia planifrons, Azadirachta indica* and *Albizzia lebbek,* the last mentioned being the most flourishing trees.

In the disreserved compartments 1 and 4, much havoc has been done to the palmyras by overcutting of leaves and *pathels* or leaf bases for fibre; besides unrestricted removal of *Dodonea viscosa* for fuel and manure has exposed large patches of once reclaimed land to wind action.

(*c*) *Kachinavilai block.*—This has been reclaimed except for the eastern portion, compartments 5 and 6, around Kalpallam where enormous stationary sand dunes can be seen. For the most part the area contains an open stand of palmyras. The eastern portion of the block, compartments 1 and part of 2, about 200 acres contains a fairly dense crop of *Dalbergia multiflora,* and is the show place of the reserve. The northern edge contains some scattered patches of *Anacardium occidentale.* The north and north-east boundary of the block abuts on the richest market garden lands of the division; these are irrigated by channels cut into the Teri sand from very ancient times, and also by water obtained from the great Kadamba tank.

(*d*) *O'neill block*.—This has also been completely planted up in the past with palmyras and is comparatively speaking well stocked.

(*e*) *Teri block*.—The western block has been completely planted up during the years 1929 to 1932. It includes however the most violently agitated portion of the whole reserve known as Naduteri. The highest point in the Teri, 190 feet above mean sea level, is in this block. The sand in the area is almost continuously on the move and dunes are continuously being formed and as continuously being disintegrated, their crests being gradually swept off by wind action as soon as a certain height is reached. The result is that both palmyra seed and seedlings are either buried deep in the sand or exposed by the scouring action of the wind; besides such seed as germinates is apt to be browsed down by the semi-wild cattle (vide paragraph 64 of Part I), which make this locality their home. In these circumstances any attempt at afforestation is almost certainly foredoomed to failure; therefore until the sand supply areas to the windward side of this block, that is, in the Nazareth and Semmarikulam blocks are efficiently afforested, and until the semi-wild cattle are removed, it will not be possible to afforest this area with any hope of success.

The eastern portion of this block is unplanted.

(*f*) *O'neill extension block*.—Planting of palmyras started here in 1919 and compartments 1 to 4 were completed. Compartments 5 to 7 were planted similarly in 1932 and only compartments 8, 9 and 10 remain to be planted. The area is fair palmyra land but the shifting sands in the Teri block on its windward side, may quite possibly in time overwhelm the young plantations in this block.

(*g*) *Lushington block*.—Planting of palmyras started in 1919, and compartments 1, 2, 3 and 4 have been completed. Palmyras in the hollows are doing fairly well but on the slightly higher intervening areas planting was a complete failure, owing to the nuts having been exposed by the scouring action of the wind or buried too deep by the moving sand. It is apparent that compartments 2 and 5 are sand supply areas, the former feeding the great dunes at Kalpallam to the east, and the latter threatening to overwhelm the Kanam block described below.

(*h*) *Kanam block*.—This is divided into three compartments planted up with palmyras in 1892 and leased out for the first time in 1914. Compartment 3 is densely stocked, compartment 2 less so, and compartment 1 is very poorly stocked.

SECTION 2.—ANALYSIS AND VALUATION OF THE CROP.

511. *General*.—Extraction of fuel or timber is not contemplated during the period of the plan, as afforestation has not progressed sufficiently to warrant such exploitation. No analysis or valuation of the crop was therefore attempted.

At present the main item of revenue in the Teri is the lease of palmyras for the cutting of leaves and for the manufacture of fibre. The following table gives the various lease units, the division into which has been effected by adopting adjacent village boundaries as limits.

Serial number and name of lease unit.	Name of village within whose limits lease area is situated.	Number of palmyras.				Annual lease amount in rupees.	Remarks.
		Paruvam.	Kattu.	Olaivettu vadali.	Total.		
1 Teri block V	Nazareth	119	226	367	712	26	Leased out for 5¾ years from 1st April 1928.
2 O'neill block IV	Kanam	289	414	25,519	26,222	325	Do.
3 Kanam block VIII, compartments 1 and 2.	Kudiraimozhi ..	299	545	4,703	5,547	40	Do.
4 Kanam block VIII, compartment 3	Do. ..	682	997	11,720	13,399	165	Do.
5 Teri block V, south of road No. 1.	Do. ..	782	1,031	2,328	4,141	..	..
6 Semmarikulam block I, compartments 4 and 7.	Semmarikulam ..	2,021	3,527	17,140	22,688	250	Leased out for 5¾ years from 1st April 1928.
7 Nazarath block II, compartments 2, 3 and 5.	Nazareth	1,280	692	20,186	22,158	182	Leased out for 4¾ years from 1st April 1929.
8 Semmarikulam block I, compartments 2, 3 and 6.	Semmarikulam ..	2,603	3,603	20,457	26,663	400	Do.
9 Teri block V, north of road No. 1.	Kudiraimozhi ..	1,034	1,252	2,346	4,632	103	Leased out for 3¾ years from 1st April 1930.

It will be observed that all the leases expire on 31st December 1933. The fact that the lease amounts for items 2 and 4 had fallen from Rs. 900 and Rs. 455, respectively during the three-year period ending 1927–28 to Rs. 325 and Rs. 165, respectively during the period of the existing contract cannot wholly be explained by the prevailing depression as the lease amount for item 8 has remained constant at Rs. 400 for the ten-year period ending 1932–33. It is most probably due to the gradual disappearance of a great proportion of the original stock of palmyras owing to overcutting of leaves and pathels. The need for special vigilance in safeguarding the growing stock from these dangers, especially in partly reclaimed areas is emphasized.

SECTION 3.—METHOD OF TREATMENT.

512. *General.*—Four factors are of importance in arriving at a conclusion as to the method of afforestation which will yield the best results—

(*a*) Wind direction and rainfall.

(*b*) Permeability of soil to moisture.

(*c*) Choice of species.

(*d*) Protection.

The bearing of each of these on the problem will be discussed below.

513. *Wind direction and rainfall.*—The north-east monsoon from October to December accounts for the bulk of the annual rainfall in the Teri (vide paragraph 24, Part I). Not only is the wind during this monsoon less violent and more intermittent, but the sand particles being moist are heavier and more coherent and therefore less easily shifted by wind action. The south-west monsoon—June to August is subject to considerable variation; paradoxical as it may seem, a strong monsoon in the west of the district usually brings a little or no rainfall on the Teri, whereas a weak monsoon is accompanied by thunderstorms which cause much local precipitation. In the former case the strong westerly gales prevalent during this season, cause considerable movement of the dry sand, and prevent the establishment of young regeneration; in the latter case no serious movement of sand takes place and new planting as well as established vegetation are given an impetus. It is therefore imperative that all new planting should be done at the beginning of the north-east monsoon, and that the scale of such operations should not be large, as in the event of the succeeding south-west monsoon being a poor one, plantations are almost inevitably bound to be failures for the most part. Moreover, as it is the west wind which causes most damage, it is essential that planting operations should start in the west and proceed towards the east.

514. *Permeability of soil to moisture.*—The sand on the Teri has been deposited upon and around a mass of impermeable marine limestone elevated at varying height above sea level; this explains the fact that all rainfall except the heaviest showers is absorbed at once, and flows out below the sandy layer quietly and continuously. The comparative success of the palmyra plantations is thus easily accounted for, as this species has a long tap root which is able to penetrate the sandy deposits rapidly and so reach the layer where a perennial water-supply exists. The frequently observed fact that both the palmyra and *Dodonea viscosa* do better in the hollows than on the dunes bears out this conclusion

515. *Choice of species.*—The two essentials of a reclaiming agent are that it should be capable of propagating itself rapidly without assistance and that it should provide fairly dense and fairly low cover. Judged by either or both these standards, the palmyra will be found wanting. It remains in the youthful *peeli* stage for seven to ten years during which it is liable to browsing by cattle as well as to submersion by the moving sand. Planted at an espacement of 10′ × 10′ the slender trunks of older trees are quite inadequate as wind breaks even in a very successful plantation. An examination of reclaimed areas in the Teri will demonstrate that *Dodonea viscosa*, *Borreria hispida* and certain grasses (*Spinefex sp.*) are the most important fixing agents. In order to ensure that palmyra seedlings in areas of shifting sand are not subsequently obliterated, it is essential that true fixation with suitable species should precede palmyra planting. The artificial propagation of the grasses mentioned above on a large scale can be ruled out as impracticable as nothing is known on the subject. The propagation of *Dodonea* is also difficult unless some method is discovered of preventing the minute seed of this species from being buried too deep or blown away. In this connexion a continuous hedge made of palm leaves stuck into the ground was found experimentally to be both costly and useless as it was soon blown away.

The prickly-pear strikes one as being likely to prove a very efficient wind break. It is comparatively easily raised, spreads rapidly, provides valuable protection against illicit grazing, and can be easily eradicated with the aid of the cochineal insect when it has fulfilled its purpose or threatens to become a nuisance. Moreover tree species such as *Acacia planifrons*, *Albizzia lebbek* and *Azadirachta indica* could be raised with greater facility under its shade.

The cashew (*Anacardium occidentale*) besides providing an appreciable revenue once it starts bearing, is one of the ideal trees from the standpoint of reclamation as it has a huge low spreading crown and is not browsed by cattle. Unfortunately it is difficult to raise without watering in the early stage. The northern edge of Kachinavillai block, compartments 1, 2 and 3 a partially reclaimed area, is ideal for this species as watering will not present any difficulty owing to the proximity of various irrigation channels taking off from both the Teri itself and the adjacent Kadamba tank.

Of the fuel species *Acacia planifrons*, *Albizzia lebbek*, *Azadirachta indica* and *Dalbergia multiflora* are the most likely to be successful. It is suggested that stump plants of the first three are likely to be more successful than either sowings or transplants.

516. *Protection.*—The destruction or removal of all the semi-wild cattle in the reserve is essential to successful reclamation. These cattle not only browse on the numerous palmyra seedlings which is the only fodder available for a greater portion of the year, but what is worse, disturb the hard surface of the soil by trampling, and thus render it more susceptible to being blown by the wind. The cutting of pathels on young palmyras for fibre manufacture has been responsible for a number of casualties.

517. *Conclusions.*—Summarising, the following conclusions may be drawn :—

(i) Palmyra plantations by themselves are inadequate as sand fixation agents; hence large scale planting operations in the east of the reserve, which contains the only hitherto unplanted area, should not be persevered in, until the western portion has been successfully reclaimed, as there is a serious risk of such plantations being overwhelmed and obliterated by moving sand in the future.

(ii) Attempts should be made to fix completely the moving sands on the western edge of the Teri with the help of the prickly-pear and fuel species and once the technique of raising such plantations has been developed afforestation should proceed methodically from west to east, so that there will always be established plantations on the windward side of new plantations.

(iii) Cashew plantations should be raised wherever watering facilities exist in view of the revenue they are likely to produce.

(iv) Semi-wild cattle should be removed from the reserve permanently.

(v) The cutting of pathels for fibre manufacturing should be restricted.

518. *Method of treatment*—(1) *Fuel plantations.*—Rectangular plots 4 chains wide from east to west and up to 5 acres in extent will be selected annually on the western edge of Nazareth block, compartment 5 being taken up first. The annual plots will be contiguous their longer sides running in an approximately north to south direction. The existing scattered tree growth on these plots will on no account be felled or damaged. *Dodonea viscosa* and prickly-pear will be introduced in alternate lines 50 apart running parallel to the longer sides of the plot.

Dodonea viscosa seed will be sown broadcast on the lines by the middle of October.

In the case of prickly-pear although the normal method of propagation is to plant the jointed branches, it is prescribed, in view of the possibility of introducing branches already infected with the cochineal insect, that only mature seed obtained from the fruit be broadcast sown in the lines by the middle of October. The question of raising the prickly-pear in nurseries from seed in order to provide uninfected branches for planting out will be considered by the District Forest Officer in the event of direct sowings being found unsuccessful.

Between the lines the area will be regenerated with *Albizzia lebbek*, *Acacia planifrons*, *Azadirachta indica* and *Dalbergia multiflora*. In order to keep planting costs low an espacement of 12′ × 12′ is advocated. It is prescribed that each of the strips into which a plot will be divided by the line sowings prescribed above will be planted up with one and the same species.

The method of regeneration to be adopted will be left to the discretion of the District Forest Officer who will consult the Provincial Silviculturist on the matter periodically. In view of the fact that the rainfall is both scanty and precarious, and the soil comparatively poor it is suggested that stump planting of such of the abovementioned species as lend themselves successfully to this treatment be attempted. With a view to stimulate the growth of plants it is suggested that each plant be treated with a little manure composed of a mixture of palmyra leaf ash and animal dung.

The boundaries of each plot will be planted up with cuttings of *Ficus bengalensis* or *Odina wodier*, each about 6′ long and 2– in diameter, spaced 1 chain apart. This operation will be completed by the 1st of November annually.

At the end of five years the result of operations will be reviewed and the area annually regenerated enlarged, if such a step appears desirable, with the previous approval of the Territorial Conservator. It should be borne in mind however that a belt of forests 4 chains wide should be established throughout the length of the western boundary of the Teri reserve *first*, and that extensions of plantations should be undertaken only on the eastern or leeward side of established plantations which are old enough to function as effective wind breaks.

(2) *Cashew plantations.*—On the eastern and northern edge of Kachinavilai blocks 5-acre plots will be selected by the District Forest Officer adjacent to the numerous irrigation channels existing there, and sown with cashew at an approximate espacement of 24′ × 24′ early in October. Stump planting of cashew may also be tried experimentally, the Provincial Silviculturist being especially consulted on this point. So far, however, his experiments point to the fact that dibbling of this species is better than stump planting in ordinary localities. In both cases watering will probably be found necessary in the year of formation. The District Forest Officer with the previous approval of the Territorial Conservator will increase the annual area planted to 10 acres or more if experience gained during the first five years justifies such a step.

(3) *Palmyra plantations.*—The south-eastern corner of Teri block V is the only unplanted area where palmyra plantations would not be in great danger of obliteration by sand. In this area 100-acre plantations will be made annually; the annual regeneration area has been marked on the 4 inches to 1 mile scale maps accompanying this plan. The palmyra nuts will be dibbled at an espacement of 10′ × 10′ in accordance with the prevailing practice care being taken that the dibbling is completed by the 15th of October. The technique of dibbling is well understood locally and the work is done quite satisfactory by contractors at a rate of Rs. 1–4–0 an acre; it is however described shortly below.

The palmyra fruit ripens usually in this locality about the first week of October. The fruit is collected by the planting contractor who is usually one of the lessees of the numerous leases of the usufruct of palmyras in the Teri reserve. Each fruit has from 1 to 3 seeds and it is these seeds which are sown. The ripe fruit is collected and sometimes stored in village manure pits for a week in order to soften the fibrous pericarp; and facilitate extraction of the seed, when large quantities have to be dealt with however, the fibrous pulp surrounding the seed is cut away with a sharp knife without injury to the pyrenes. The seed is transported to the planting area on pack bulls and dumped in heaps evenly over the area. The seed in these dumps is tested by Forest subordinates and all insect attacked and immature ones rejected.

The area to be dibbled is divided into convenient sized rectangular or square compartments by straight lines, the boundaries of these compartments being demarcated by lines of dry palmyra leaves stuck into the ground at suitable intervals.

The actual dibbling is effected thus :—Six ropes each 100 feet in length are obtained and each rope is marked in 10-foot sections by cloth tags attached to the rope. A 100-foot section of one of the compartment boundaries is measured off by one of the ropes first. Two other ropes are pegged at right angles to this base line. The three remaining ropes are stretched across the planting square parallel to the base line. One coolie being in charge of each end of a rope; the distance between each rope is 10 feet. A set of three to four coolies are employed on each rope, one of whom digs pits about 1 foot deep at each 10 feet mark, in the loose sand with one or two strokes of a mumooti while the rest follow him dibbling a seed (from a supply carried in a cloth tied round their waists) in each pit and pushing in the excavated sand into the pit with their hands simultaneously. As soon as four lines (including the base line) are thus completed, the four ropes are shifted to the next 40-foot section and the operations repeated. Although the operations as described appear to be complicated the celerity with which they are done is surprising. When one 100-foot square has been completed an adjacent one is taken up and so on until the whole area has been dealt with.

519. *Table of operations.*—The following table details the various operations to be carried out during the period of the plan.

Year.	Fuel plantations.		Cashew plantations.		Palmyra plantations.		Remarks.
	Locality.	Area in acres.	Locality.	Area in acres.	Locality.	Area in acres.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1934–35 ..	Nazareth block.	5	Kachinavilai block.	5	Teri East block.	100	
1935–36 ..	Do.	5	Do.	5	Do.	100	
1936–37 ..	Do.	5	Do.	5	Do.	100	
1937–38 ..	Do.	5	Do.	5	Do.	100	
1938–39 ..	Do.	5	Do.	5	Do.	100	
1939–40 ..	Do.	5	Do.	5	Do.	100	Area in columns (3) and (5) subject to revision.
1940–41 ..	Do.	5	Do.	5	Do.	100	
1941–42 ..	Do.	5	Do.	5	Do.	100	
1942–43 ..	Do.	5	Do.	5	Do.	100	
1943–44 ..	Do.	5	Do.	5	Do.	100	

SECTION 4.—SUBSIDIARY SILVICULTURAL REGULATIONS.

520. *Nurseries.*—In case stump planting is decided upon a nursery will be required for raising sufficient seedlings of tree species to plant up 5 acres annually. At an espacement of 12′ × 12′, 300 stumps will be required per acre. It is suggested that the following mixture of species be adopted—

	PER CENT.
Albizzia lebbek	25
Acacia planifrons	25
Azadirachta indica	25
Dalbergia multiflora	25

The most suitable site for a nursery is near the Nazareth rest-house as watering can be effected without much difficulty when required, and frequent inspection facilitated. It will be necessary to manure the soil annually in order to maintain its productive capacity and for this purpose a large pit effectively screened off from the moving sand will be permanently maintained.

In case stump planting of cashew proves more successful than dibbling, as is possible, a second nursery for raising a sufficient number of cashew seedlings for stump planting the 5-acre plots in Kachinavilai block—vide paragraph 12 above—will be required; this should be established close to a perennial source of water-supply in the Kachinavilai block.

521. *Replacing of casualties.*—All casualties in both the fuel and cashew plantations will be replaced in the second year as soon as the first showers of the north-east monsoon are received, that is, early in November normally.

522. *Tending.*—It is not anticipated that any weeding will be necessary. In the case of a total failure of the south-west monsoon some watering of both the fuel and cashew plantations will probably be found necessary to reduce casualties. Lean to shelters formed by sticking palmyra leaves on either side of each plant would not only reduce damage by moving sand but also minimize exposure to the sun. It is suggested that such shelters may with advantage be erected early in May succeeding the year of planting; it is necessary to ensure by frequent inspection that these shelters do not fall across the plants and injure them.

523. *Avenues.*—With a view to establishing avenues on all the main rights of way in the Teri each beat guard will plant up all such paths in his beat with cuttings of *Ficus bengalensis* or *Odina wodier*. The cuttings should not be less than 6 feet in length and 2 inches in diameter. Half a mile of path will be planted up annually, the cuttings being spaced about a chain apart along either side of the length of the road.

SECTION 5.—OTHER REGULATIONS.

524. *Palmyra leases.*—These form the principal item of revenue in the Teri. The various lease units are detailed in paragraph 510 above, and no change in them is contemplated as the prospective lessees have been accustomed to them for a long time and any alteration of boundaries would cause confusion. It is prescribed however that the disreserved compartments of Nazareth and Semmarikulam blocks respectively, will be included in these blocks as soon as they are re-notified as reserved forest under section 16 of the Madras Forest Act. The newly reserved area will be distributed over lease units 6, 7 and 8 by the District Forest Officer after consulting the convenience of the prospective lessees.

525. *Period of lease.*—The original leases were for a period of ten years and this was later reduced to five years. All the leases expire on 31st December 1933. Long leases were advocated in the past owing to the apprehension that annual leases would encourage lessees to overcutting of leaves and pathels with the object of obtaining the maximum revenue. On the other hand long leases are undesirable as they are apt to deteriorate into gambles on the part of the lessee on the future prices of palmyra produce; if they go up he profits, while if there is a slump he suffers and as recent experience has shown frequently repudiates his contract. A lease period of three years would minimize both these disadvantages and will therefore be adopted; all palmyras belonging to the Revenue Department are leased out for this period. As the produce has now been advertised for sale by the District Forest Officer for a period of one year, for 1934, this prescription will come into force only from the beginning of 1935.

526. *Conditions of lease.*—(1) The lessee will have uncut at least eight of the topmost leaves on all palmyras in the area leased out to him. This is necessary in order to preserve the vitality of the tree.

(2) All dead leaves should be cut before removal of the green leaves.

(3) Cutting of pathels for fibre manufacture will be permitted only on trees over 10 feet in height.

(4) All dead trees in the area leased out to the lessee will be reported to the Range Officer as soon as they are observed by the lessee, his agent or his coolies.

(5) No lopping or removal of tree or shrub growth will be permitted under any circumstances within the area leased out, and the contractor will be liable for any such lopping discovered by the Forest subordinates, if it is proved that his workmen have visited the locality in question and failed to report the occurrence.

(6) In the tapping of trees for pathanir (sweet sap) or toddy (fermented sap) the lessee will adhere to the rules of the Abkari Department and be responsible for the payment of all dues to this department.

(7) The lessee will supply free of charge to the Forest Department such quantity of leaves as are required for regeneration operations, on a proper requisition signed by the District Forest Officer or any officer authorized by him.

527. *Sowing palmyra nuts by lessee.*—Under the old leases the lessee was required to sow palmyra nuts on a proportion of the leased area annually so that the whole area was completely sown by the end of the lease period. In the absence of any supervision this clause was easily evaded and very little in this direction was done. The existence of the clause however cannot but have contributed towards a diminution of the lease amount. Wholesale planting of palmyras without a preliminary attempt to fix the moving sand is to be deprecated as great loss is inevitable. It is therefore prescribed that the clause requiring lessees to sow palmyra nuts on a proportion of the leased area annually be deleted from all future contracts.

528. *Wind direction.*—It is desirable that the exact wind direction from time to time be accurately ascertained in the Teri; at present this is known only from individual opinions. It is therefore prescribed that a cheap weather-cock be erected on the Nazareth rest-house and the wind direction recorded once a week by the local Forester. Visitors at the rest-house should be encouraged to record their observations in this connection in the bungalow book, as this would serve as a valuable check.

529. *Semi-wild cattle.*—Methods of getting rid of semi-wild cattle have been prescribed in detail in paragraph 471 of Chapter VII.

SECTION 6.—CONTROL.

530. *Control.*—The following control records will be maintained by the District Forest Officer :—

(*a*) Record of works.

(*b*) Plantation journal.

(*c*) Control map.

(*d*) Control journal.

(*a*) *Record of works.*—This will be a brief record of all works with costs, carried out annually in the reserve in connexion with the improvement of the growing stock in the reserve. The various operations will be classified as follows :—

(i) Those prescribed in the working plan.
(ii) Those suggested in the working plan.
(iii) Those neither prescribed nor suggested but carried out.

(*b*) *Plantation ledger.*—This will be a detailed annual record of the various operations undertaken in the raising of the plantations prescribed with costs. Expenditure will be recorded monthly for the first two years and thereafter annually. Separate records will be maintained for the fuel and cashew plantations respectively. No separate ledger need be maintained for the palmyra plantations as the work is given on contract the annual rate being recorded in the Record of Works.

(*c*) *Control map.*—The area regenerated annually will be shown on the 4-inch scale maps of the Teri accompanying this plan; the years during which regeneration operations were carried out will also be noted on the maps.

(*d*) *Control journal.*—This will be in the form of a bound foolscap book and will contain a record of all noteworthy occurrences, bearing on the management and improvement of the forest. It is emphasized that only observations recorded in the field and information not obtainable from prescribed forms, should be noted in this journal. The whole of the Teri will be regarded as a unit for the purposes of this journal.

Sample forms of Control records (*a*) and (*b*) and sample headings for the Control journal are given in Appendices XXVI to XXIX.

CHAPTER XI.—MISCELLANEOUS PRESCRIPTIONS.

SECTION 1.—MISCELLANEOUS.

531. *General.*—There are a number of subjects which cannot legitimately be treated under any of the previous working circles; neither can they be dealt with under separate working circles as the area dealt with is either not reserved forest (patta sandal), or is scattered in small patches all over the division (bamboo) or is to be treated experimentally during the period of the plan (Valliyur reserve). Manure leaf removals are restricted to the forests of Nanguneri and Srivilliputtur Ranges; the constitution of separate manure leaf felling series in those ranges is out of the question as all the area suitable for this purpose has been pre-empted by the fuel felling series; the subject will therefore be dealt with under this chapter.

A.—Patta Sandal.

532. *Patta sandal.*—There is some sandal in the patta lands adjoining the Alagarkoil valley in Srivilliputtur Range; the majority of it is to be found on the lands some 300 acres in extent belonging to the Srivilliputtur temple. The patta lands adjoining the sandal area in the Kuttalam reserve also contain sandal to a very limited extent.

The position in this division is quite different from that in North Coimbatore, as Government here has no right whatsoever to any of the sandal growing on patta lands. With the exception of the Srivilliputtur temple trustees who occasionally extract sandal for the requirements of the temple only and not for commercial purposes, the other pattadars do not appear to realize the value of the sandal on their lands, much of the regeneration being burnt periodically during cultivation operations. Buying and extracting the green sandal is out of the question as many of the pattadars are unwilling to sell, and even if they could be induced to do so by the offer of exorbitant prices, there is every likelihood that the land would once again be brought under sandal naturally, as much of it is situated adjacent to sandal bearing tracts in the reserved forest. Finally "agreements" with the pattadars to buy the existing growth of sandal will be unilateral unless consideration is paid at the time of execution of such agreements; they will therefore be impossible to enforce legally.

As the quantity available is small and not likely to increase largely in the future owing to the increasing pressure of cultivation, patta sandal working is not recommended. Adequate control over patta sandal can be secured by a rigorous application of the Sandalwood Transit Rules. Attempts will, however, be made by the District Forest Officer to induce pattadars to sell their dead sandalwood trees to us for extraction, the rate of payment therefor being decided by the Territorial Conservator.

B.—Bamboo.

533. *Bamboo.*—The bamboo (*Bambusa arundinacea*) is to be found in scattered patches, each varying from 1 to 25 acres in extent in the following localities in the division :—

Name of range.	Locality.	Quantity.	Remarks.
Srivilliputtur ..	1 Valaikulam reserve	A few clumps	....
	2 Mouth of Alagarkoil valley ..	Do.	....
	3 The Gandamanayakanur path above the cairns line.	A few dozen clumps ..	Flowering 1933.
	4 The left bank of the Ammankoil Ar.	Do. ..	Do.
	5 The right bank of the Rajamparai Ar.	Do. ..	Do.
Kuttalam ..	6 Vasudevanallur reserve ..	Exploitable	Flowered and died in 1928–29.
	7 Vadagarai Melpidagai and Kilpidagai reserves.	A few clumps	Do.
	8 Kuttalam reserve, Vallam beat.	Exploitable	Flowered and died in 1930–31.
Ambasamudram ..	9 Kadayam	Do.	Flowered and died in 1931–32.
	10 Sivaisalem	Do. ..	Flowering 1933.
	11 Idaimuttikidai Koilteri beat ..	Do.	....
	12 Aladiyur	Do.	....
	13 Kariar	Do.	....
Nanguneri ..	14 Kalakad Timber cum Fuel Felling Series.	A few clumps	....
	15 Kodamadi Ar valley	A few dozen clumps ..	....
	16 Valliyur reserve	Exploitable	....
	17 Mungilpattikidai valley ..	A few 100 clumps ..	Flowering 1933; exploitable if bamboo prices rise.

534. *Bamboo working.*—The following prescriptions relating to bamboo working are laid down :—

(i) The felling cycle will be three years. For the purpose of working, the exploitable bamboo areas in each range will be grouped together into one felling series each area being worked once in three years. There is no necessity for regulating the volume yield, as the supply forms a very small percentage of the annual requirements of the division which are met from the forests of the adjacent Travancore State. The following table gives a statement of fellings :—

Name of felling series.	Years of working.	Bamboo area.	Remarks.
Kuttalam	1934–35, 1937–38, 1940–41, 1943–44	I Kuttalam reserve, Vallam beat.	Subject to their being old enough for working.
	1935–36, 1938–39, 1941–42	II Vasudevanallur reserve ..	Do.
Srivilliputtur	1936–37, 1939–40, 1942–43	III Ayyanar koil and Mudangiar beats.	....
Ambasamudram	1934–35, 1937–38, 1940–41, 1943–44	IV Aladiyur beat	....
	1935–36, 1938–39, 1941–42	V Sivaisalem beat .. .. VI Kariar beat	....
	1936–37, 1939–40, 1942–43	VII Koilteri beat (Idaimuttikidai).	....
Nanguneri	1934–35, 1937–38, 1940–41, 1943–44	VIII Valliyur reserve (first block).	The area has been divided into two blocks on the ground, the Valaiuthu Ar being the common boundary.
	1935–36, 1938–39, 1941–42	IX Valliyur reserve (second block).	....
	1936–37, 1939–40, 1942–43	X Mungilpattikidai valley ..	....

(ii) The present system of marking the culms to be extracted in each clump departmentally, prior to sales will be abandoned; the contractor will be required to reserve all first year culms and at least eight older culms in each clump in order to ensure mechanical support and also to provide sufficient nutriment for the natural extension of the clump. Subject to this restriction all other culms in a clump may be felled. He will also be prohibited from felling any culm higher than 3 feet from ground level, in order to avoid congestion in the clumps.

(iii) Flowering of *Bambusa arundinacea* takes place usually in three stages—

(*a*) preliminary sporadic flowering,

(*b*) gregarious flowering, and

(*c*) final sporadic flowering of the remaining clumps.

As soon as stage (*b*) is observed in any locality the whole area will be put up for sale in public auction, all restrictions regarding felling being removed. The period of contract will be the official year and if at the end of this some culms are left unworked the area will be sold once more in the succeeding year.

(iv) The District Forest Officer will be permitted to put up for sale any of the small bamboo areas mentioned in paragraph 533, but not included in the tabular statement of fellings, provided he is satisfied that a demand exists and the clumps are exploitable. Every such area will be exploited only once in three years working being regulated by the above prescriptions.

535. *Bamboo regeneration.*—Given a suitable soil, adequate rainfall and protection from browsers in the early stages bamboo is comparatively easily raised; there is the additional advantage that returns can be expected in a shorter period than from any other forest tree crop. The only species of commercial importance in South India are *Bambusa arundinacea* and *Dendrocalamus strictus*. The former has been successfully

introduced artificially in the division in various localities, the prices obtained varying from Rs. 30 to Rs. 100 per 1,000 bamboos. The latter is more usually found in areas above 2,000 feet elevation, and hence its value in this district is limited, as most of the otherwise suitable areas above this elevation are inaccessible. As a means of covering poor steep grass land cheaply, the value of this bamboo is considerable.

536. *Bambusa arundinacea.*—The following prescriptions regarding the artificial introduction of this bamboo are laid down :—

(i) The area to be planted will be the flat portion of the Aladiyur plateau not included in the Koilteri Timber cum Fuel Felling Series.

(ii) An area of 5 acres will be taken up annually in this locality and planted up as detailed below at an espacement of 33′ × 33′.

(iii) The best method of propagation is to raise two or three-year old seedlings in a nursery; at this stage the young seedling will have developed a rhizome of about the thickness of one's thumb; the seedling with rhizome is then dug up carefully from the nursery bed and the stem cut off at a height of about 6 inches above ground-level; the off-set thus obtained is ready to be planted out in the forest. It should be planted deep enough to cover the first two or three nodes which are usually found close together at the base of the stem. For this purpose the soil for a radius of 6 inches round each stake will be dug up to a depth of 1 foot, the off-set put in and the well-powdered soil filled in and lightly pressed round it. The method outlined will be adopted; the District Forest Officer in consultation with the Provincial Silviculturist will be permitted, however, to alter the method of propagation if a better method is evolved.

(iv) At an espacement of 33′ × 33′, 200 seedlings will be required annually for the 5 acres; allowing a reserve of 25 per cent for casualties 250 seedlings will have to be raised annually in a nursery. It is suggested that in order to facilitate watering and inspection and to minimize danger from browsing by wild animals, the nursery be established in the Mundanthorai rest-house compound. The seed will be sown early in June in longitudinal rows 6 inches apart in each nursery bed and lightly covered with well-powdered soil. In the absence of rain the beds will be kept watered with a fine sprayed watering can until germination sets in. After this they need be watered only if the seedlings show signs of wilting.

(v) For the first two years, when rhizomes are not yet available, the District Forest Officer will address the Provincial Silviculturist and ask him if he can obtain supplies for him from other districts; this is usually possible.

Similarly if seed is not available locally the Provincial Silviculturist should be asked if he can obtain it elsewhere. Should seed of *Bambusa arundinacea* not be available *Dendrocalamus strictus* should be propagated instead.

The off-sets will be planted out in the forest as soon as the first showers in April-May have made the ground soft enough for planting. Each off-set will be surrounded by a circular thorn fence at least 5 feet high in order to prevent damage from browsers.

(vi) Casualties will be replaced at the beginning of the second growing season with off-sets from the nursery.

(vii) The District Forest Officer with the previous approval of the Territorial Conservator will be at liberty to introduce this bamboo in any other area which he considers suitable, provided that such area is not already included under the Timber cum Fuel or Fuel Working Circles, and that it is sufficiently accessible to make bamboo planting a remunerative proposition.

537. *Dendrocalamus strictus.*—The introduction of this species of bamboo on the sparsely clothed hill slopes below the Sengalteri rest-house in Nanguneri Range is recommended as an inexpensive method of afforesting this area with a crop which will not only improve the quality of the grass under it but also prove ultimately remunerative. At present this area is covered with very sparse tree growth and a coarse tall grass (*Andropogon sp.*) which is not only of no nutritive value to cattle, but also prevents seed of tree species from reaching the soil. Beyond fire line clearing and perhaps the control of working in one annual coupe in the Sengalteri Evergreen Timber Reserve Felling Series, the Sengalteri beat guard and watcher will have no regular work. It is therefore suggested that they be employed in raising small plantations of this bamboo in this locality. At an espacement of roughly 33′ × 33′, 40 off-sets will be required per

acre, and 200 off-sets or 5 acres can be comfortably dealt with annually. The nursery practice and method of planting will be the same as that detailed in paragraph 536 above. Seed will have to be obtained either through the Provincial Silviculturist or from North Coimbatore or Kollegal divisions.

C.—The Valliyur Reserve.

538. *Character of the vegetation.*—This reserve of 600 acres was originally a mass of shifting red sand and its reservation was undertaken with a view to fixing the sand with tree growth and thereby preserving the valuable Valliyur irrigation channel on the north-eastern boundary of the reserve from obliteration. The object of reservation has been successfully attained; along the channel a narrow belt is now covered with an artificially introduced growth of bamboo, young sandal, mahogany, *Eugenia jambolana*, *Pterocarpus marsupium* and *Albizzia lebbek*; the remaining portion of the reserve contains grass, scattered palmyra growth and miscellaneous fuel species, principally *Dalbergia multiflora*.

539. *Afforestation.*—With a view to afforesting this reserve and increasing the revenue per acre ultimately it is desirable that experimental plantations be undertaken to discover the least expensive and most successful method for large scale operations.

540. *Planting plan.*—It is accordingly prescribed that 2-acre plantations of each of the following species be established *annually* along the Valliyur channel to the west of the bamboo plantations :—

Serial number.	Species.	Area in acres.
1	*Albizzia lebbek* and cashew	2
2	*Pterocarpus marsupium* and cashew	2

541. *Espacement.*—*Albizzia lebbek* will be introduced at an espacement of 12′ × 12′ as it is fast growing and has a spreading crown; *Pterocarpus marsupium* will be introduced at an espacement of 6′ × 6′. Both plantations will be simultaneously planted with cashew at an espacement of 24′ × 24′ care being taken that this species is planted in the centre of a planting square.

542. *Method of planting.*—The method of planting to be adopted will be left to the discretion of the District Forest Officer who will consult the Provincial Silviculturist on the matter. In the first year however pending preparation of a nursery, dibbling before the south-west monsoon (early in May) will be done, followed by replacing of casualties (with transplants raised in a nursery) during the first burst of the north-east monsoon.

The area selected will be surveyed and sold in auction if it contains any saleable fuel early in December. Removals should be completed by the end of the succeeding March and any felled material remaining, together with the grass heaped in lines and burnt. Staking will be completed by the end of April.

543. *Tending.*—A first weeding consisting of cutting of grass and weeds interfering with the young plants will be done in July; and a second weeding consisting of clean scraping to a width of 2 feet on each side of a row of plants will be done in October just before the north-east monsoon is expected. The scraping may be accompanied by forking if the Provincial Silviculturist advises it. At these weedings, casualties if any will be replaced. It is expected that the tending of the small areas involved can easily be done by the local beat subordinates free of cost. Tending in the second year will be left to the discretion of the District Forest Officer who will order such operations as are necessary to be done.

544. *Extension of plantations.*—The success of these plantations will be reviewed by the District Forest Officer after five years, and an increased area of the most successful species or mixture of species will be taken in hand thereafter with the previous approval of the Territorial Conservator.

545. *Grazing.*—The whole reserve will remain closed to grazing but cutting of fodder grass free of charge should be permitted and actively encouraged under the supervision of the beat subordinates.

D.—Manure leaf.

546. *Manure leaf.*—The concession of removal of this produce from the reserves is permitted in Srivilliputtur and Nanguneri Ranges on payment of a seigniorage of $2\frac{1}{2}$ annas per headload. The forests on the outer slopes of these two ranges have been progressively deteriorating and total closure to manure leaf removal is the only means of arresting this process. The Collector of Ramnad has agreed to closure of the forests of Srivilliputtur Range, but the Collector of Tinnevelly considers closure in Nanguneri

Range is inadvisable on the ground of the present economic condition of the ryots; he has however agreed to raising of the seigniorage to 4 annas per headload or Rs. 5 per cartload for three years preliminary to closure. These proposals have been agreed to tentatively by the Chief Conservator of Forests (vide C.C.F.'s Ref. No. 7703/32-c. 1. dated 3rd September 1933.).

547. *Prescriptions.*—It is accordingly laid down that pending further orders of the Chief Conservator of Forests on the subject—

(1) The forests of Srivilliputtur Range will be closed to all manure leaf removals.

(2) The forests of Nanguneri Range will be open to the manure leaf removal for a period of three years ending 31st March 1936, the seigniorage rate being 4 annas per headload or Rs. 5 per cartload. The question of complete closure of the forests of Nanguneri Range will be examined in December 1935 and a report submitted in January 1936 by the District Forest Officer to the Chief Conservator of Forests through the Territorial Conservator, so that early orders on the subject may be obtained.

548. *Species removable.*—The leaves of only the following trees and shrubs will be removable for manure leaf purposes :—

Botanical name.	Vernacular name.
(1) *Acalypha fructicosa*	Seeny.
(2) *Cassia auriculata*	Avaram.
(3) *Calotropis gigantea*	Yercum.
(4) *Dalbergia paniculata*	Adukkuvagai or pachelai.
(5) *Dodonea viscosa*	Virali.
(6) *Erythroxylon monogynum* ...	Semmana.
(7) *Givotia rottleriformis*	Vandalai.
(8) *Gyrocarpus jacquinii*	Vellai thanaku.
(9) *Helicteres isora*	Valamburi.
(10) *Mundulea suberosa*	Pullavarai.
(11) *Stenosipronium russellianum* ...	Kurinji.
(12) *Streblus asper*	Pira.
(13) *Tephrosia purpurea*	Kolinji.
(14) *All creepers.*	

549. *Method of working.*—At present manure leaf tickets are issued to the public departmentally by the Range Officer concerned or Foresters specially authorized to do so. This system is open to serious abuse as the checking officer is also the issuing officer. It is therefore recommended that the right to collect manure leaves in Nanguneri range be sold in public auction, the lessee being constrained to issue the usual permits at a fixed rate of 4 annas per headload. In this way the maximum revenue will be secured to Government and at the same time corruption of subordinates will be minimized as the lessee or his agents in their own interests will be efficient checks on the subordinate staff.

SECTION 2.—CONTROL.

550. *Control.*—The following control records will be maintained by the Disrict Forest Officer :—

(*a*) Control book (bamboo exploitation).

(*b*) Record of works. (Bamboo areas and Valliyur reserve.)

(*c*) Control journal.

(*a*) *Control book.*—This will contain a record of all bamboo areas exploited in each range annually and periodically with prices obtained.

(*b*) *Record of works.*—Separate registers of forms will be maintained for all operations carried out in connexion with (*a*) the artificial propagation of bamboo in the division (*b*) the raising of tree species in Valliyur reserve. The operations carried out will be classified under the following heads in each case :—

(i) Those prescribed in the working plan.

(ii) Those recommended or suggested in the working plan.

(iii) Those neither prescribed nor suggested but carried out.

(c) *Control Journal.*—Three control journals will be maintained.

(i) Bamboo control journal.

(ii) Valliyur afforestation control journal.

(iii) Manure leaf control journal.

(i) *The Bamboo Control Journal.*—This will contain observations made by the District Forest Officer in the field as to the adequacy or otherwise of working plan prescriptions, the advisability of introducing bamboo in other localities in the division with reasons, the ruling prices of bamboo at various markets, and the costs of extraction from various bamboo areas. Short notes on the various methods of propagation of bamboos practised with results and costs should also be included.

(ii) *The Valliyur afforestation Control Journal.*—This will contain observations made by the District Forest Officer in the field on the adequacy or otherwise of the working plan prescriptions, notes on the various species attempted to be introduced with comments on the degree of success obtained in relation to the costs.

(iii) *Manure Leaf Control Journal.*—This will contain observations on the species most in demand, the period of maximum demand, costs of removal excluding seigniorage, and a comparison of revenue obtained under departmental collection and through the agency of contractors. Samples of the control book and of the record of works are given in Appendices XXX (*a*), (*b*) and (*c*).

SECTION 3.—GAME PRESERVATION.

551. The paucity of game, especially of Ibex, in the division, is in a large measure due to the prevalence of illicit shooting and the failure to enforce rigidly on the shooting licence holder, the conditions under which these licences are issued. The following prescriptions are accordingly made :—

(i) When a shot which cannot be adequately accounted for is heard, when machans or shelters of any kind are seen, when traps or snares are found, or when game in a particular locality has obviously diminished the District Forest Officer will take disciplinary action against the subordinate concerned.

(ii) It is well known that certain licence holders entrust their guns to others who thus shoot illicitly, whether their principals are present or not. Again, a recent development on the Mundanthorai plateau in Ambasamudram range, is the shooting of game, other than carnivorae from motor cars, machans, etc., with the aid of aritificial lights at night; this is to be expressly prohibited. Every effort should be made by every one concerned, to detect such offenders, and on apprehension, the name of the offender should be posted on a " Black List " maintained for the purpose in the District Forest Office.

(iii) The names of all persons convicted of shooting offences in a court of law, should be posted on the " Black List " alluded to above, and no individual whose name has been so posted should be given a shooting licence for a period of *at least* 3 years after the date of conviction. The Territorial conservator will examine the list during the annual office inspection in order to ensure that it is up to date.

(iv) Each beat subordinate will post the approximate position of all salt licks and water holes in his beat, and the Range officer concerned will inspect all such places half yearly, preferably during the hot weather and certify to the effect that they are free from machans and hides. The District Forest officer will check a certain number of beats in each Range in order to satisfy himself of the accuracy of such certificates. It is recommended that the Kalakad, Terukuiangudi and Vallanad beats of Nanguneri Range, the Sivasalem and Govendaperi beats of Ambasamudram Range and the beats in Kuttālam and Vasudevanallur reserves of Kuttalam Range be particularly visited in this connexion as they are favoured resorts of poachers.

(v) The District Forest Officer will ensure by periodical surprise visits that Ibex in the localities mentioned in paragraph 68, part I, chapter II, section III Fauna, and the black buck in Vallanad reserve are not subject to poaching. The rule regarding the size of head of these animals which it is permissible to shoot is embodied in the shooting licence and should be rigidly enforced.

CHAPTER XII.—ESTABLISHMENT AND LABOUR.

SECTION 1.—ESTABLISHMENT.

552. *Executive staff.*—The adequacy of the existing strength of the executive staff has been discussed in paragraph 114 of Part I. The present Kodamadi and Kannikatty Ranges will be amalgamated to form the new Ambasamudram Range. Kuttalam and Srivilliputtur Ranges will remain unaltered.

The Srivaikuntam Range will be combined with the Nanguneri Range; in the event of its being discovered as a result of *five years working* that the fuel plantations prescribed in the Kudiraimozhi Teri Reserve—vide paragraph 518, are sufficiently successful to warrant their extension on a larger scale, or that the protection of the reserves in the old Srivaikuntam Range cannot be adequately supervised by the Nanguneri Range Officer, it is prescribed that the Government be addressed through the proper channels to sanction an additional Range Officer for the old Srivaikuntam Range. It is for this reason that the two ranges are separately dealt with in this working plan.

The Ambasamudram Range Officer will be provided with an assistant Range Officer in case departmental working of the Ambasamudram Evergreen Timber Felling Series is decided upon.

553. *Headquarters staff.*—The staff at headquarters will consist of—

District Forest Officer	1
Head clerk and Accountant	2
Draughtsman	1
Clerks	5
Typist	1
Peons	4
Office watcher (temporary establishment)	1

The staff of clerks has been increased by one for reasons detailed in Part I, Chapter IV, paragraph 117; the additional clerk will be transferred from Kuttalam Range.

554. *Range establishments.*—The statement below shows the Range establishment which it will be necessary to employ during the period of the plan :—

Designation.	Name of range. Srivilliputhur.	Kuttalam.	Amba-samudram.	Nanguneri.	Total.
Range Officers	1	1	1	1	4
Foresters	2	2	4	2	10
Forest guards	10	13	13	17	53
Reserve watchers	10	13	11	17	51
Bungalow watchers	...	1	1	1	3
Range clerks	1	1	2	2	6
Peons	1	1	1	1	4
Boatman	...	...	1	...	1

555. *Foresters.*—The distribution of work among the foresters allotted to each range will be left to the discretion of the District Forest Officer. The only prescription in this connexion will be that an experienced forester be stationed at Nazareth under the supervision of the Nanguneri Range Officer to carry out works in, and be responsible for the protection of, the Kudiraimozhi Teri and Vallanad Reserves.

556. *Forest Guards' beats.*—The following table shows the distribution of forest guards' beats in the division as proposed in this working plan; their boundaries have been marked on the 4 inches scale maps accompanying the plan, each beat having been allotted a serial number. The sanctioned strength of forest guards in the division is at present 58, of which 53 are employed in charge of beats and 3 on special duty. A careful examination of the nature and quantity of the work which will be required to be done during the working plan period in each of the existing beats has revealed the possibility of reducing the number of beats, in order to ensure that all guards are provided with occupation throughout the year. The number of beats has accordingly been reduced to 51 and the number of special duty guards to 2. The District Forest Officer, however, will be permitted for adequate reasons and with the previous approval of the Territorial Conservator, to increase the number of beats or alter their boundaries as laid down in the working plan maps provided the sanctioned strength of 58 forest guards is not exceeded. The revised boundaries of all the beats have been marked on the management and 4 inches to 1 mile scale maps accompanying this plan; it is prescribed that each beat guard be provided with a plan of his beat on a scale of 1 inch to 1 mile and the Range Officer concerned will see that the guard is able to read the map correctly and locate the boundaries concerned.

Serial number and name of beat.	Headquarters.	Approximate distance of outer boundary. M.	F.	Remarks.
	Srivilliputtur Range.			
1 Khansapuram	Khansapuram	11	0	....
2 Pudupatti	Pudupatti	8	0	Government quarters.
3 Kunnur	Kunnur	5	4	....
4 Rengathirtham	Srivilliputtur	6	4	....
5 Rengarkoil	Do.	6	0	....
6 Alagarcoil	Athithondu	2	4	Government quarters.
7 Athithondu	Do.	7	0	Do.
8 Valaikulam	Do.	11	0	Do.
9 Ayyanarkoil	Mudangiar	6	4	Do.
10 Rajamparai	Do.	7	0	Do.
	Kuttalam Range.			
11 Vasudevanallur	Naranapuram	2	2	Government quarters.
12 Naranapuram	Do.	7	4	Do.
13 Karuppasamikoil	Chellapuli	4	0	Do.
14 Puliangudi	Melapuliangudi	4	4	Do.
15 Chitamani	Do.	7	4	Do.
16 Krishnapuram	Kumantbapuram	3	4	....
17 Kadayanallur	Kadayanallur	3	6	....
18 Chinnakadu	Kasidarmam	3	4	....
19 Panpuli	Panpuli	5	0	....
20 Vallam	Vallam	2	0	....
21 Kuttalam	Kuttalam	3	0	Government quarters.
22 Aiyaraperi	Do.	3	4	Do.
23 Mathalamparai	Mathalamparai	2	4	....
	Ambasamudram Range.			
24 Kadayam	Mettur	4	0	....
25 Govindaperi	Govindaperi	4	0	....
26 Sivaisalem	Sivaiselam	5	0	Government quarters.
27 Ambur	Do.	5	0	Do.
28 Korayar	Papanasam	3	4	Do.
29 Aladiyur	Do.	8	4	Do.
30 Koilteri	Pechiammankoil	Nil.		Do.
31 Padaramalai	Mundanthorai	Nil.		Do.
32 Kodamadi	Kodamadi	Nil.		Do.
33 Kariar	Mundanthorai	Nil.		Do.
34 Kannikatti	Kannikatti	Nil.		Do.
	Nanguneri Range.			
35 Kolundamamalai	Sermadevi	16	0	....
36 Terku Virrvanallur	Puthukudi	4	4	....
37 Padmaneri	Padmaneri	6	4	Government quarters.
38 Vadagarai	Sivanaperi	5	4	Do.
39 Sengalteri	Koovapatti	Nil.		Do.
40 Kalakad	Sivanaperi	3	6	Do.
41 Malayadipudur	Do.	6	4	Do.
42 Nambikoil	Nambiar site	4	6	Do.
43 Tirukurangudi	Do.	3	2	Do.
44 Valliyur	Tirukurangudi	5	6	....
45 Parivarisuriyan	Do.	4	6	....
46 Vallanad	Vallanad	9	6	....
47 Manakarai	Manakarai	9	6	....
48 Kachinavilai	Kuchinavilai	5	6	....
49 Nazareth	Nazareth	6	4	....
50 Kanam	Kanam	5	4	....
51 Kayamoli	Kayamoli	7	4	....

In addition to the above two additional special duty guards have been provided for Ambasamudram Range, one for evergreen regeneration work and the other for teak plantation operations.

It is suggested that the hill beat guards and reserve watchers be recruited as far as possible from among the Kanis as the majority of plainsmen cannot withstand for long the rigours of the climate and the separation from their families and hence make inefficient subordinates.

557. *Bungalow watchers.*—These subordinates will continue to be employed at the rest-houses in Kuttalam, Mundanthorai and Sivanaperi, respectively, as these bungalows are frequently visited by the public.

A boatman will be necessary as at present, at Mundanthorai for the ferry across the Serviar.

558. *Range clerks.*—One of the range clerks in the Kuttalam Range will be retrenched and employed in the District Forest office—vide paragraph 553.

SECTION 2.—LABOUR SUPPLY.

559. *Labour.*—The present supply of unskilled labour is quite sufficient for the works proposed in the working plan; there is therefore no necessity to import such labour. On the hills in Ambasamudram Range, the Kanis should be preferred to plainsmen for all unskilled work as they are cheaper and if properly treated, more dependable than plainsmen.

In the event of departmental felling in the Ambasamudram Evergreen Timber Felling Series, being decided upon, sawyers will have to be imported either from Rajapalayam or Travancore State.

The raising of teak plantations in the Clear Felling Working Circle in Ambasamudram Range with the aid of Kani ponamdars is of the utmost importance, and the District Forest Officer should make every effort to secure their good will and co-operation both by giving them all reasonable concessions, and by ensuring that they are not oppressed by subordinates.

CHAPTER XIII.—FINANCIAL FORECAST AND COST OF THE WORKING PLAN.

SECTION 1.—REVENUE.

560. *Timber.*—Exploitation in the Evergreen Timber Working Circle will provide revenue under this head. Only the revenue from the Ambasamudram Felling Series has been considered, as working of the Sengalteri and Chittar Reserve Felling Series will be remunerative only if there is a marked appreciation in the prices of evergreen timber. On the basis of an average annual exploitation of 500 trees and an average price of Rs. 6 per tree, the revenue will amount to Rs. 30,000 during the period of the plan.

561. *Fuel and small timber.*—Under this head the revenue will be obtained from :—

(*a*) The Timber cum Fuel Working Circle.

(*b*) The Fuel Working Circle.

(*c*) The Clear Felling Working Circle.

(*d*) The Miscellaneous Working Circle.

The estimates of revenue under (*a*) and (*b*) have been based on the average revenue per acre during the past ten years in each felling series, this figure being modified where necessary by the calculation, based on ocular estimates of the standing crop, of the net value of the growing stock to be exploited in each felling series during the period of the plan—vide table below :—

The Timber cum *Fuel Working Circle.*

Serial number and name of felling series.	Average price per acre. First rotation.	Second rotation.	Third rotation.	Ten years ending 1933–34.	Working plan estimate.	Total area to be exploited 1934–35 to 1943–44, 1,217 acres.	Total revenue.
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	ACS.	RS.
1 Ayyanarkoil	..	65 10 0	..	52 4 0	70 0 0	1,217	85,190
2 Puliyangudi	12 11 0	51 10 0	..	70 15 0	75 0 0	734	55,050
3 Kuttalam	19 0 0	25 0 0	96 0 0	69 0 0	70 0 0	500	35,000
4 Koilteri	..	33 8 0	31 8 0	34 0 0	35 0 0	788	27,580
5 Padaramalai	..	48 10 0	24 0 0	38 0 0	35 0 0	1,008	35,280
6 Kalakad	39 6 0	64 4 0	..	59 8 0	50 0 0	1,026	51,300
						Total ..	2,89,400

The Fuel Working Circle.

Serial number and name of felling series.	First rotation.	Second rotation.	Third rotation.	Ten years ending 1933–34.	Working plan estimate.	Total area.	Total revenue.
1 Unipathimalai	..	..	..	..	10 0 0	540	5,400
2 Pudupatti	15 5 0	..	..	20 6 0	20 0 0	757	15,140
3 Rengarkoil	4 3 0	21 10 0	..	24 0 0	15 0 0	662	9,930
4 Alagarkoil	..	..	..	..	25 0 0	670	16,750
5 Valaikulam	17 0 0	34 14 0	..	39 8 0	30 0 0	499	14,970
6 Vasudevanallur	11 6 0	32 4 0	43 14 0	45 0 0	50 0 0	993	49,650
7 Karuppasamikoil	11 6 0	29 2 0	51 7 0	53 8 0	50 0 0	979	48,950
8 Kadayanallur	7 14 0	23 0 0	40 8 0	30 15 0	30 0 0	703	21,090
9 Chinnakadu	..	..	..	..	30 0 0	451	13,530
10 Madalamparai	..	..	..	..	30 0 0	754	22,620
11 Govindaperi	..	..	..	..	10 0 0	438	4,380
12 Sivasalem	23 14 0	..	..	..	20 0 0	744	14,880
13 Ambur	..	..	..	12 13 0	15 0 0	652	9,780
14 Korayar	..	..	..	30 9 0	24 0 0	525	12,600
15 Kolundamamalai	..	..	..	15 5 0	15 0 0	412	6,180
16 Padmaneri	..	..	..	19 3 0	15 0 0	552	8,280
17 Vadagarai	10 2 0	62 7 0	..	56 11 0	40 0 0	727	29,080
18 Malayadipudur	..	..	..	23 0 0	20 0 0	213	4,260
19 Nambikoil	..	..	..	..	20 0 0	431	8,620
20 Tirukurangudi	..	61 0 0	..	51 13 0	30 0 0	533	15,990
21 Parivarisuriyan	..	..	..	31 0 0	20 0 0	460	9,200
22 Vallanad	..	..	..	10 2 0	10 0 0	905	9,050
						Total ..	3,50,330

The average price per acre of the standing crop works out at Rs. 55 for the Timber cum Fuel Working Circle and Rs. 26 for the Fuel Working Circle.

Under (*c*), the revenue will be obtained from the sale of 200 acres of forest in the Clear Felling Working Circle at an average price of Rs. 35 per acre—vide paragraph 381 above, and from the sale of teak poles obtained from thinnings; the net revenue from the latter source has been estimated to be Rs. 1,000 per annum.

Under (*d*), the revenue will be provided by the sale of 40 acres of forest in Valliyur reserve—vide paragraph 540 above at an average price of Rs. 5 per acre.

562. *Sandal.*—The average annual yield is estimated to be 4 tons—vide paragraph 432 above. At Rs. 1,000 per ton the total revenue during the period of the plan will be Rs. 40,000.

563. *Grazing.*—The grazing revenue has been estimated to average Rs. 8,000 per annum—vide paragraph 467. A small revenue of Rs. 200 per annum is expected to be obtained from the sale of penning licences.

564. *Minor forest produce.*—The revenue from this source including the revenue from manure leaves and the usufruct of palmyras in the division is estimated to average Rs. 12,000 per annum, the average of the past five years being Rs. 12,169.

565. *Bamboos.*—The revenue from the sale of bamboos has been estimated to average Rs. 1,200 per annum, the average of the past five years being Rs. 1,281. The leases of Eta reed are included under this head.

566. *Miscellaneous.*—The revenue from other sources including confiscated produce fines and forfeitures, rents of buildings, compounding fees in forest offences, permits sold to contractors, etc., is expected to average Rs. 13,500 per annum, the average of the past five years being Rs. 13,247.

In addition Revenue Department receipts are estimated to bring in on an average Rs. 30,300 per annum, the average of the past five years being Rs. 30,218.

SECTION 2.—EXPENDITURE.

567. *Exploitation.*—The expenditure on exploitation will be dealt with under the following heads :—

(*a*) Demarcation and survey of annual coupes in the Timber cum Fuel, Fuel, and Clear Felling Working Circles, respectively.

(*b*) Demarcation and marking of trees for felling in the Ambasamudram Felling Series of the Evergreen Timber Working Circle.

(*c*) Sandal extraction.

(*d*) Commission to permit-issuing officers.

Under (*a*) an expenditure of Rs. 490 per annum has been provided for and under (*b*) an expenditure of Rs. 50 per anuum has been estimated for, based on past actuals. Under (*c*) the cost of extraction including transport to Tiruppattur Sale Depot has been estimated at Rs. 80 per ton based on past actuals. Under (*d*) the commission to permit-issuing officers at 5 per cent on the value of grazing permits issued will amount to Rs. 400 per annum.

568. *Regeneration.*—Full details of the artificial regeneration prescribed in the various working circles are set out in the appropriate columns of the financial forecast—vide paragraph 575 below. The total average annual expenditure under this head is estimated to be Rs. 3,078.

569. *Fire protection.*—The annual expenditure on fire protection has been estimated to average Rs. 1,500—vide paragraph 493 above.

570. *Roads and bridges.*—A capital expenditure of Rs. 10,000 for the construction of stone causeways across the Serviar and Kariar rivers in Ambasamudram Range has been provided for. Since the Kattalaimalai estate authorities have agreed to pay half the cost of these causeways up to a limit of Rs. 5,000 only the balance of Rs. 5,000 has been estimated for—vide paragraph 498.

Under new roads short lengths of feeder cart-tracks will be required in the Evergreen Timber Working Circle in order to facilitate extraction. Rs. 500 has been provided annually on this account.

The annual maintenance of existing roads, vide paragraph 496 above, has been estimated to require Rs. 3,875 per annum. In addition all other roads and paths not required to be repaired annually are prescribed to be maintained by the respective beat subordinates; a sum of Rs. 325 per annum has been provided for special repairs to such roads and paths.

571. *Buildings.*—A capital expenditure of Rs. 1,400 for the construction of inspection sheds at Kariar and Ayyanarkoil, respectively—vide paragraph 500 above, and the construction of motor-sheds at Athithondu and Nazareth, respectively, has been provided for.

The annual maintenance of all existing buildings until they are disposed of or written off under proper sanction has been prescribed—vide paragraph 499. The cost is estimated to be Rs. 2,500 per annum based on past actuals.

Rs. 50 per annum has been provided for cleaning wells and Rs. 10 per annum for repairs to rain gauges.

The erection of three rain gauge stations at Nazareth, Sivanaperi and Nambikoil, respectively, at a total cost of Rs. 75 has been provided for.

572. *Stores, tools and plant.*—An ordinary expenditure of Rs. 400 per annum and a capital expenditure of Rs. 400 per annum has been provided for under this head based on past actuals.

573. *Establishment.*—The statement below gives the data on which the annual average expenditure on the pay of the establishment has been calculated :—

Headquarters establishment.

	RS.
(1) District Forest Officer (Deputy Conservator of Forests) on Rs. 997 per mensem	11,964
(2) Head clerk and accountant on Rs. 70 per mensem	1,680
(3) Seven clerks on Rs. 45 per mensem	3,780
(4) Four peons on Rs. 15 per mensem	720
(5) One office watcher on Rs. 10 per mensem	120
Total ...	18,264

Range establishment.

(1) Four Rangers at Rs. 138 per mensem	6,624
(2) Six Range clerks at Rs. 45 per mensem	3,240
(3) Ten Foresters at Rs. 37 per mensem	4,440
(4) Fifty-three Forest guards at Rs. 17 per mensem	10,812
(5) Four peons at Rs. 15 per mensem	720
(6) Fifty-one Reserve watchers at Rs. 10 per mensem	6,120
(7) Three bungalow watchers at Rs. 10–8–0 per mensem ...	380
(8) One boatman at Rs. 11–8–0 per mensem	138
Total ...	32,474

The total expenditure under this head amounts to Rs. 50,736 per annum.

The following amounts will be required annually as allowances for the staff employed :—

	RS.
Travelling allowance (non-voted)	1,800
Travelling allowance (voted)	3,000
Fixed travelling allowance	1,150
Conveyance allowance for four Rangers at Rs. 15 each per mensem	720
Other compensatory allowances for two Foresters at Rs. 9 per mensem each and eight Forest guards at Rs. 3 per mensem each	504

574. *Miscellaneous.*—Expenditure on supplies and services, service postage, tour charges and office expenses, is expected to average Rs. 3,100 per annum based on past actuals.

The annual cost of the Conservator and his establishment is estimated to be Rs. 44,000. As there are five divisions in the circle, the cost to be debited to this division amounts to Rs. 8,800.

SECTION 3.—SUMMARY OF REVENUE AND EXPENDITURE.

575. *Summary.*—The tabular statement below gives complete details of the estimated revenue and expenditure during the period of the plan.

Financial forecast for the ten-year period 1934–35 to 1943–44.

Serial number and particulars. (1)	Revenue. Rate. (2)	Reference to paragraph. (3)	Amount expected to be realized. (4)	Remarks. (5)	Serial number and particulars. (6)	Expenditure. Rate. (7)	Reference to paragraph. (8)	Amount expected to be spent. (9)	Remarks. (10)
I. *Evergreen Timber Working Circle*—	RS.		RS.		I. *Evergreen Timber Working Circle*—	RS. A. P.		RS.	
(*a*) To revenue realized by the sale of 5,000 trees in the Ambasamudram Felling Series.	6 per tree.	273	30,000	The Sengalteri and Chittar Reserve Felling Series have not been considered here as working is expected to be remunerative only in case there is a marked improvement in evergreen timber prices.	(*a*) Regeneration of 2,000 acres in the Ambasamudram Felling Series. The operation includes nursery charges, dibbling, transplanting and tending for two years.	3 0 0 per acre.	278 & 279	6,000	It is anticipated that all the coupes in this series will be worked during the period of the plan although the coupes have not been allotted to definite years.
					(*b*) Special tending of natural regeneration in the annual coupes over an area of 25 acres per annum.	2 0 0 per acre.	274	500	
					(*c*) Marking of trees in the annual coupe including cost of demarcation.	50 0 0 per annum.	270	500	
II *Timber cum Fuel Working Circle*—					II. *Timber cum Fuel Working Circle*—				
(*a*) To revenue realized by the sale of 5,273 acres in the six felling series.	55 per acre.	310 & 561	2,90,015	....	(*a*) Survey and demarcation of 60 coupes including cost of coupe stones.	25 0 0 per coupe.	301	1,500	
					(*b* Artificial regeneration by rab sowing over 3,556 acres. The operation consists of burning and trenching in broken lines, mixing up soil and ash and sowing or stump planting on ridges preferably ½ chain apart.	0 12 0 per acre.	314	2,667	The area is exclusive of coupes in the Kuttalam and Ayyanarkoil Series. Reliable data as to the cost of this work are not available. A rate of 12 annas per acre is considered reasonable as only up to 25 per cent of the area of each coupe will be regenerated annually.
					(*c*) Artificial regeneration by the Walayar system of 10 acres in the Kuttalam Felling Series and 30 acres in the Ayyanarkoil Felling Series annually. The operation consists in stump planting with teak at an espacement of 12 feet by 12 feet and tending of the crop for two years.	10 0 0 per acre.	318	4,000	
					(*d*) Artificial regeneration with teak in the coupes of the Kuttalam felling series. The operation consists of planting teak at an espacement of 6 feet by 6 feet over up to 10 acres annually through the agency of ponamdars, free of cost.	10 0 0 per acre.	315	1,000	If ponamdars are not available for any reason the area will be planted up under the Walayar system. Hence Rs. 10 per acre have been provided for including tending for 2 years.

Financial forecast for the ten-year period 1934–35 to 1943–44—*cont.*

Revenue.

Serial number and particulars.	Rate.	Reference to paragraph.	Amount expected to be realized.	Remarks.
(1)	(2)	(3)	(4)	(5)
	RS.		RS.	
III. *The Fuel Working Circle*— To reven e realized by the sale of 13,600 acres in the 22 felling series.	26 per acre.	355 & 561	3,53,600	....
IV. *The Clear Felling Working Circle*—				
(*a*) To revenue realized by the sale of 200 acres of forest.	35 per acre.	381	7,000	....
(*b*) To net revenue realized by the sale of teak poles removed by thinnings of existing teak plantations.	1,000 per annum.	416	10,000	....
V. *The Sandal Working Circle*—				
(*a*) To revenue realized by the sale of 40 tons of sandalwood.	1,000 per ton.	434	40,000	....

Expenditure.

Serial number and particulars.	Rate.	Reference to paragraph.	Amount expected to be spent.	Remarks.
(6)	(7)	(8)	(9)	(10
	RS. A. P.		RS.	
III. *The Fuel Working Circle*—				
(*a*) Survey and demarcation of 220 coupes including cost of coupe stones.	15 0 0 per coupe.	346	3,300	
(*b*) Artificial regeneration by rab sowings over 13,600 acres. The operation consists of burning and trenching in broken lines, mixing up the soil and ash and sowing seeds on ridges preferably one chain apart.	0 8 0 per acre.	357	6,800	The rate provided is considered reasonable as only up to 25 per cent of the area of each coupe will be taken up for regeneration.
IV. *The Clear Felling Working Circle*—				
(*a*) Survey and demarcation of 10 coupes.	10 0 0 per coupe.	380	100	
(*b*) Planting 200 acres of Forest with teak stump plants at an espacement of 6 feet by 6 feet. The cost includes tending for 2 years and introducing admixture of rosewood and *Balanccarpus utilis*.	25 0 0 per acre.	422	5,000	Provision is made for this expenditure although the planting is expected to be done by ponamdars free of cost excepting nursery charges.
V. *The Sandal Working Circle*—				
(*a*) For the extraction of 40 tons of final cleaned sandalwood.	80 0 0 per ton.	110	3,200	The rate in column 9 includes cost of rough and final cleaning and transport to Tiruppattur sale depot.
(*b*) For tending on a 6 year cycle for the 10 year period over a total area of 6,695 acres in the Alagarkoil Felling Series.	0 1 6 per acre.	445 & 446	628	The operation consists of climber cutting and freeing sandal from overhead covers. It is expected that a cooly on a daily wage of 6 annas will cover 4 acres a day-
(*c*) Tending on a 3 year cycle over a total area of 2,708 acres for the 10 year period in the sandal area in Kuttalam reserve.	0 1 0	446	170	The lower rate is considered reasonable as the tending cycle is shorter.
(*d*) Strip regeneration of 20 acres during the 10 year period in Alagarkoil Felling Series. The operation consists of collection of seed, cutting of lines, sowing and protection against browsing, etc.	6 0 0 per acre.	447	120	....

VI. *The Grazing Working Circle—*				
(*a*) To revenue realized by the sale of grazing permits and penning licences.	8,200 per annum.	467 & 563	82,000	....
VII. *The Minor Forest Produce Working Circle—*				
To revenue realized by the sale of various items of minor forest produce by units.	12,000 per annum.	564	1,20,000	Includes usufruct of palmyras in the afforestation working circle.
VIII. *The Afforestation Working Circle.*	..	..	..	....
IX. *The Miscellaneous Working Circle—*				
(*a*) By the sale of bamboos in the division.	1,200 per annum.	534	12,000	The average of the past five years is Rs. 1,281.
(*b*) By sale of 4 acres of Forest in Valliyur reserve annually.	5 per acre.	540	200	....
(*c*) To revenue realized by the sale of confiscated produce, fines and forfeitures, rents of buildings, compounding fees in forest offences, etc.	13,500 per annum.	566	1,35,000	The average of the past five years is Rs. 13,247.
X. *Revenue Department Receipts—*				
(*a*) By sale of timber	300 per annum.	566	3,000	Average of past five years is Rs. 296.
(*b*) By sale of firewood and charcoal.	15,500 per annum.	566	1,55,000	Average of past five years is Rs. 15,543.

VI. *The Grazing Working Circle—*				
(*a*) By payment of commission to Permit Issuing Officers at per cent on Rupees 80,000.	5 per cent.	460	4,000	The commission will be paid on the sale of grazing permits only.
VII. *The Minor Forest Produce Working Circle—*				
Rewards to subordinates for good work in establishing crops of *Terminalia chebula.*	50 per annum.	481	500	....
VIII. *The Afforestation Working Circle—*				
(*a*) Planting of palmyra nuts on 100 acres per annum at an espacement of 10 feet by 10 feet in the Kudiramozhi Teri reserve.	1 4 0 per acre.	518 & 519	1,250	....
(*b*) Planting of fuel and sand fixation species experimentally on 5 acres per annum in Nazareth block of Kudiramozhi Teri reserve.	10 0 0 per acre.	518 & 519	500	The area planted during each of the first five years may be less than 5 acres but with experience gained it is expected that the area will be enlarged later on.
(*c*) Planting of Cashew on 5 acres per annum on the north-eastern edge of the Kudiramozhi Teri reserve.	15 0 0 per acre.	518 & 519	750	....
IX. *The Miscellaneous Working Circle—*				
(*a*) Planting bamboo seedling cuttings at an espacement of 33 feet by 33 feet over 5 acres annually in Aladiyur beat.	5 0 0 per acre.	536	250	*Bambusa arundinacea* or *Dendrocalamus brandisi will be tried.* The planting will be done by beat subordinates. Provision is made for fencing alone.
(*b*) Planting bamboo seedling cuttings at an espacement of 33 feet by 33 feet over 5 acres annually in Sengalteri beat.	5 0 0 per acre.	537	250	*Dendrocalamus strictus* only will be tried. The planting will be done by beat subordinates. Provision is made for fencing alone.
(*c*) Planting of fuel and small timber species experimentally over 4 acres annually in Valliyur reserves.	10 0 0 per acre.	540	400	....
X. *Fire protection—*				
(*a*) Of State and Zamindari boundaries totalling 37½ miles. The operation will consist of the annual burning of a 60 feet wide line along the common frontiers.	12 0 0 per mile per annum.	488	4,500	The full estimated cost is shown in the financial statement although it is prescribed that steps be taken to obtain half contribution from the States and Zamindaris concerned.
(*b*) Of frequented roads and paths totalling 65½ miles.	6 0 0 per mile per annum.	489	3,930	The operations will be done at the discretion of the District Forest Officer, deviations being previously approved of by the territorial Conservator.

Financial forecast for the ten-year period 1934–35 to 1943–44—*cont.*

Serial number and particulars.	Revenue. Rate.	Reference to paragraph.	Amount expected to be realized.	Remarks.	Serial number and particulars.	Expenditure. Rate.	Reference to paragraph.	Amount expected to be spent.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
X. *Revenue Department Receipts*—cont. (c) By sale of other minor forest produce.	RS. 14,500 per annum.	566	RS. 1,45,000	Average of past five years is Rs. 14,379.	X. *Fire protection*—cont. (c) Of sandal areas and important sholas by interior fire lines totalling 17½ miles.	RS. A. P. 12 0 0 per mile per annum	490	RS. 2,100	....
....	..	..	..	....	(d) Employment of temporary fire patrols during the fire season.	380 0 0 per annum.	491	3,800	....
....	..	..	..	....	(e) Rewards to subordinates for detection of incendiaries.	67 0 0 per annum.	492	670	....
					XI. Purchase of stores and tools, etc. Items common to all working circles.	800 0 0 per annum.	505	8,000	The average of the past five years is Rs. 838.
					XII. Communications and Buildings— (a) Roads and bridges (new works)—				
					(i) Causeways at Mundanthorai and Kariar.	5,000 0 0 each.	498	..	Only Rs. 5,000 is provided as the balance will be contributed by the Kattalamalai Estate.
					(ii) New roads—Short lengths of feeder cart-tracks in the Evergreen Timber Working Circle will be required.	500 0 0 annually.	570	..	The average of the past five years is Rs. 882.
					Interest at five per cent per annum for half the period of the plan on Rs. 10,000 on items (i) and (ii) as the works proposed are to be executed progressively during ten years.	..	..	2,500	....
					(b) Annual maintenance of existing roads 134 miles 7 furlongs.	3,875 0 0 per annum.	496	38,750	....
					(c) Special repairs to other roads and paths to be maintained by subordinates.	325 0 0 per annum.	497	3,250	The average annual expenditure under (b) and (c) for the past five years is Rs. 4,292.
					(d) Buildings (new works)— (i) Inspection sheds at Kariar and Ayyanarkoil respectively.	500 0 0 each.	500	..	....
					(ii) Motor sheds at Athithondu and Nazareth respectively.	200 0 0 each.	500	..	....
					Interest at five per cent on Rs. 1,400 [items (i) and (ii)] for two-and-a-half years as these	5 per cent per annum.	..	175	....

buildings are expected to be completed in the first five years of the working plan period.					
(e) Maintenance of existing buildings. The average of the past five years is Rs. 2,563.	2,500 0 per annum.	499 & 571	25,000	....
(f) Maintenance of existing wells.	50 0 0 per annum.	571	500	....
(g) Maintenance of rain-gauge stations.	10 0 0 per annum.	504 & 571	100	....
(h) Erection of three rain-gauge stations at Nazareth, Sivanaperi and Nambikoil respectively.	25 0 0 each.	504 & 571	75	....
XIII. *Establishment*—				
(a) Controlling staff—				
District Forest Officer ..	997 0 0 per mensem.	573	1,19,640	....
(b) Executive staff—				
(i) Four rangers	138 0 0 per mensem.	573	66,240	....
(ii) Ten foresters	37 0 0 per mensem.	573	44,400	....
(c) Protective staff—				
Fifty-three forest guards (fifty-one for beat charges and two for special duty).	17 0 0 per mensem.	573	1,08,120	....
(d) Office establishment—				
(i) Nine clerks in District Forest office.	455 0 0 per mensem.	573	54,600	....
(ii) Range establishment— Six range clerks ..	45 0 0 per mensem each.	573	32,400	....
(e) Temporary establishment—				
(i) Reserve watchers, fifty-one for beat protection.	10 0 0 per mensem each.	573	61,200	....
(ii) Bungalow watchers, one each for Kuttalam, Mundanthorai and Sivanaperi rest-houses.	10 8 0 per mensem each.	573	3,780	....
(iii) Boatman, one for Mundanthorai ferry.	11 8 0 per mensem.	573	1,380	....
(f) Menials, eight peons (four for District Forest Officer and four for Range Officers).	15 0 0 per mensem each.	573	14,400	....
One watcher for District Forest Office.	10 0 0 per mensem.	573	1,200	....
XIV. Allowances—				
(i) Travelling allowances (non-voted).	1,800 0 0 per annum.	573	18,000	Average of past five years is Rs. 2,120.
(ii) Travelling allowances (voted).	3,000 0 0 per annum.	573	30,000	Average of past five years is Rs. 3,798 but two rangers have been retrenched.
(iii) Fixed travelling allowance.	1,150 0 0 per annum.	..	11,500	....

Financial forecast for the ten-year period 1934–35 to 1943–44—*cont.*

Serial number and particulars.	Revenue. Rate.	Reference to paragraph.	Amount expected to be realized.	Remarks.	Serial number and particulars.	Expenditure. Rate.	Reference to paragraph.	Amount expected to be spent.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	RS.		RS.			RS. A. P.		RS.	
					XIV. Allowances—*cont.*				
					(iv) Other compensatory allowances.	1,225 0 0 per annum.	573	12,250	
					XV. Miscellaneous.—				
					Supplies and services—				
					Service postage, tour charges and office expenses.	3,100 0 0 per annum.	574	31,000	Average of past five years is Rs. 3,108.
					XVI. Direction.—				
					The annual cost of the Conservator and his establishment is estimated to be Rs. 44,000. As there are five divisions in the Circle, one-fifth of this amount is debited to this division.	8,800 0 0 per annum.	574	88,000	
		Grand total ..	13,82,815				Grand total ..	8,34,845	

576. *Abstract.*—The statement below gives an abstract of revenue and expenditure under various heads :—

Abstract of financial forecast for the period of the plan.

Revenue.		Expenditure.	
Serial number and particulars.	Amount expected to be realized.	Serial number and particulars.	Amount expected to be spent.
(1)	(2)	(3)	(4)
	RS.		RS.
1 Timber	30,000	1 Exploitation	12,600
2 Fuel and small timber	6,60,815	2 Regeneration	30,785
3 Sandal	40,000	3 Fire protection	15,000
4 Bamboos	12,000	4 Roads and bridges	41,500
5 Grazing	82,000	5 Buildings and wells	25,850
6 Minor forest produce	1,20,000	6 Miscellaneous	8,000
7 Miscellaneous	4,38,000	7 Establishment and contingent charges.	6,10,110
		8 Direction	88,000
Grand total ..	13,82,815	Grand total ..	8,34,845

	RS.
Anticipated surplus of revenue over expenditure during the ten-year period ..	5,47,970
Annual anticipated profit	54,797
The gross revenue per acre	5·34
The management cost per acre	3·27
The surplus per acre	2·07
The percentage of expenditure to gross revenue	61·2 %

577. *The surplus.*—The annual surplus is expected to average Rs. 54,797 which is Rs. 3,892 less than the average surplus during the five-year period ending 1932–33, but is Rs. 11,490 greater than the average surplus during the two years 1931–1933, during which all trade has been affected by the general depression ; it is on the ruling prices of these years of depression that the estimates of yield made in this working plan have been based and therefore better results than those shown may confidently be expected. The financial results of the division are governed largely by the prevailing price of fuel and small timber, which are the most important forest products of the division. The markets for these products being principally local, prices are dependant on the purchasing power of the population. The population being principally agricultural its purchasing power has been seriously affected by the great fall in the prices of agricultural produce. The estimates of revenue being based on current prices are therefore conservative and are almost certainly liable to be exceeded when the existing trade depression lifts and a consequent restoration to the price levels prevailing before 1930–31 results. Taking into consideration the fact that the conservative exploitation, and the regeneration measures prescribed in the plan will not only ensure a sustained annual yield but also considerably increase the future value of the growing stock, the increased annual surplus expected is a cause for satisfaction.

578. *Past revenue and expenditure.*—The comparative statement below shows the revenue and expenditure for the five-year period ending 1932–33 and the financial forecast of revenue and expenditure of the working plan.

Revenue.

Serial number and particulars. (1)	1928–29. (2)	1929–30. (3)	1930–31. (4)	1931–32. (5)	1932–33. (6)	Average of past five years. (7)	Forecast of working plan. (8)	Difference plus or minus. (9)
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
1 Timber	7,075	3,994	8,727	6,945	4,649	6,278	3,000	— 3,278
2 Fuel and small timber	72,251	93,657	90,395	54,991	56,138	73,486	66,081	— 7,405
3 Sandal	1,155	5,769	1,763	6,031	4,817	3,907	4,000	+ 93
4 Bamboo	849	899	1,920	1,071	1,668	1,281	1,200	— 81
5 Grazing	8,740	7,442	8,426	7,286	7,942	7,967	8,200	+ 233
6 Minor forest produce	13,383	14,592	13,468	9,588	9,816	12,169	12,000	— 169
7 Miscellaneous ..	53,076	46,185	39,665	37,641	40,709	43,455	43,800	+ 345
Total ..	1,56,529	1,72,538	1,64,364	1,23,553	1,25,739	1,48,543	1,38,281	— 10,262

Expenditure.

Serial number and particulars. (10)	1928–29. (11)	1929–30. (12)	1930–31. (13)	1931–32. (14)	1932–33. (15)	Average of past five years. (16)	Forecast of working plan. (17)	Difference plus or minus. (18)
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
1 Exploitation ..	19,189	10,557	13,186	10,705	7,335	12,194	1,260	— 10,934
2 Regeneration ..	851	2,978	2,941	1,254	1,895	1,984	3,078	+ 1,094
3 Fire protection ..	607	929	675	556	641	681	1,500	+ 819
4 Roads and bridges.	5,950	5,831	6,127	3,797	4,054	5,152	5,450	+ 298
5 Buildings and wells.	4,124	3,089	3,720	2,604	2,962	3,300	2,725	— 575
6 Miscellaneus ..	535	731	2,162	523	1,437	1,078	800	— 278
7 Establishment and contingent charges, etc. ..	61,937	59,054	55,032	53,914	53,400	56,667	61,011	— 4,344
Total ..	93,193	83,169	83,843	73,353	71,724	81,056	75,824	— 5,232
Surplus of revenue over expenditure ..	63,336	89,369	80,521	50,200	54,015	67,487	62,457	— 5,030
Total ..	1,56,529	1,72,538	1,64,364	1,23,553	1,25,739	1,48,543	1,38,281	— 10,262

N. B.—(1) For purposes of comparison in columns 16 and 17 (namely, the average of the past five years and the forecast of the working plan) the cost of direction (Conservator's pay and establishment) has not been included although it has been assessed at Rs. 8,800 per annum and included in the detailed financial forecast—vide paragraph 575.

(2) It should be also realized that although Rs. 61,011 is charged for establishment in accordance with the standard averages laid down, nevertheless the actual expenditure under this head has for the past three years averaged only Rs. 54,115 per annum. The actual surplus will therefore probably be about Rs. 7,000 greater than that shown.

SECTION 4.—COST OF THE WORKING PLAN.

579. *Cost of the plan.*—The division was formed on the 22nd November 1931 and was closed on 10th April 1934. The details of expenditure under various heads are noted below :—

	RS.	A.	P.
Pay of officers (non-voted)	15,908	2	0
Pay of officers (voted)	10,510	6	0
Pay of establishment	17,509	3	0
Travelling allowance (non-voted)	2,853	5	0
Travelling allowance (voted)	3,734	10	9
Fixed travelling allowance	1,090	11	0
Other compensatory allowances	409	10	0
Contingencies	1,401	14	2
Working plans (field work)	2,287	9	3
Total ...	55,705	7	2

This expenditure works out at 3·47 annas per acre of forest.

CHAPTER XIV.—SUMMARY OF PRESCRIPTIONS.

	PARA.	PAGE.
1. *Area and distribution.*—The working plan covers an area of 258,997·67 acres or 404·68 square miles divided for administrative purposes into 4 ranges namely—		1 & 8
ACS.		
Srivilliputtur .. .. 45,802·06		....
Kuttalam .. .. 51,588·28		
Ambasamudram .. .. 83,211·94		
Nanguneri .. .. 78,395·39		
2. The main objects of management are briefly—		
(i) to obtain revenue by extraction of mature and over-mature timber from the evergreen forests ;	245	97
(ii) to regulate the supply of fuel, small timber and agricultural implements with reference to the requirements of villages and towns in the vicinity of the forest ;		
(iii) to obtain revenue from the extraction of dead sandal trees ..		
(iv) to obtain revenue from minor forest produce ;		
(v) to supply the pastoral needs of the population ;		
(vi) to promote the fixation of moving sand dunes in the Kudiramozhi Teri reserve ;		
(vii) to maintain the fuel forests in an increasing state of productivity by supplementing natural regeneration artificially where necessary, by converting suitable areas clothed with a comparatively unremunerative type of growth into teak plantations by increasing artificially the proportion of valuable species in evergreen forests and by the regular tending of teak plantations and of sandal growth in sandal areas, and		....
(viii) to protect the forests from fire		....
3. *Working Circles.*—The areas of the various working circles are as shown below—		
ACS.		
(1) The Evergreen Timber Working Circle 2,959	249	99
(2) The Timber cum Fuel Working Circle 20,550		
(3) The Fuel Working Circle 40,630		
(4) The Clear Felling Working Circle 802		
(5) The Sandal Working Circle 4,742		
(6) The Minor Forest Produce Working circle .. The whole working plan area.		
(7) The Grazing Working Circle 126,751		
(8) The Afforestation Working Circle 11,371		

	PARA.	PAGE.
4. Recommendations of the Royal Commission on Agriculture		
(i) *Pennisetum cenchrolles* will be introduced experimentally in Nazareth block on one acre plots and the results reviewed after 5 years with a view to abandoning the experiment if unsuccessful or increasing the area planted, if successful	251	99
(ii) The removal of fodder grass in all areas closed to grazing except fire burnt areas, will be conceded free of charge for bona fide domestic purposes. The leasing out of this right for commercial purpose in areas open to grazing will be continued	252	100
(iii) The removal of brushwood from the major portion of all fuel coupes will be continued to assist the jaggery industry	255	100
(iv) The shifting cultivation by the Kanis will be restricted to a 40 acre plot on the Peyar in Ambasamudram range	256	100
5. The period of the plan will be 10 years, from 1st April 1934 to 31st March 1944. Revision will be undertaken not later than January 1943	257	100
6. *The Evergreen Timber Working Circle* consists of all accessible evergreen forest containing over 5 exploitable trees per acre.		
(i) The working circle has 3 felling series; of these, only the Ambur felling series is exploitable; the other two reserve felling series being less accessible are expected to be exploitable only in case evergreen timber prices increase appreciably.	262	104
(ii) The method of treatment is to extract mature trees of valuable species by selection fellings on a girth limit fixed empirically for groups of species; the yield will be regulated by area	263–264	104
(iii) The felling cycle will be 10 years	267	105
(iv) Extraction will be limited to 3 trees per acre evenly distributed over the coupe. Rules for marking are given ..	270	106
(v) Extraction will be by contract agency ordinarily but departmental extraction may be undertaken	271	106
(vi) Charcoal burning under restrictions will be permitted ..	272	106
(vii) The sequence of coupes alone is fixed and not the year of working	271 & 273	
(viii) Natural regeneration of valuable species will be tended under supervision of District Forest Officer in the annual coupe over a minimum area of 25 acres at an estimated cost of Rs. 2 per acre	274	107
(ix) Artificial regeneration by dibbling and transplanting will be conducted in such gaps as require to be regenerated, i.e., gaps over 100 square yards in extent and not less than 8 yards in width	275 & 276	107 & 108
(x) First year tending consisting of cutting out grass, weeds and inferior species and light soil aeration round seedlings will be done in June	279	109
(xi) Second-year tending similar to the above is prescribed ..	280	109
(xii) The working circle will be closed to grazing..	281	110
(xiii) All charcoal pits will have inflammable material round them removed for a radius of 20 feet. The contractor will be held responsible for all fires in the annual coupe	282	110
(xiv) Accurate records of yield in Form III will be maintained ..	283	110
(xv) Inspection paths connecting all gaps under regeneration will be made and maintained for two years by local subordinates.	284	110
(xvi) One-acre experimental plantations of *Hopea parviflora, Dipterocarpus bourdilloni, Acrocarpus fraxinifolius* and *Artocarpus hirsuta* in mixture at an espacement of 6 feet by 6 feet will be made in Ullar	285	110
7. *The Timber cum Fuel Working Circle* consists of all accessible deciduous forest capable of growing small timber on a rotation of 40 years—		
(i) The working circle is divided into six felling series	295	112
(ii) The silvicultural system will be the simple coppice system ..	297	112
(iii) The rotation will be 40 years	298	112
(iv) The yield will be regulated by area	299	113
(v) The annual coupe will be surveyed and demarcated in accordance with the felling series map by cut lines 10 feet wide by Range Officer. District Forest Officer to check 25 per cent of the surveys. Each coupe to be divided into not less than three strips	301 & 302	113 & 114

	PARA.	PAGE.
(vi) Indicator areas to be felled by lessees	303	114
(vii) Extraction to be through the agency of contractors ..	304	114
(viii) Reserved species	306	115
(ix) Disposal of arrear areas	305	114
(x) Felling is to proceed strip by strip ; felling rules are given in paragraph 307. All small timber to be hammer-marked by beat Guard before removal who will maintain an account. Range Officers to send monthly abstracts of these accounts to District Forest Officer	307 & 309	115
(xi) The method of regeneration will be by rab sowings of timber species in broken lines 1 (one) chain apart, over an area not exceeding 25 per cent of the area of the annual coupe. The operation to be done in August, September and in April-May	313–314	116–117
(xii) Teak plantations not exceeding 10 acres in extent will be formed annually by stump planting in the coupes of Kuttalam Felling Series. Espacement will be 6 feet by 6 feet. Seeds of *Dalbergia latifolia* or *Pterocarpus marsupium* will be sown at each stake in order to obtain a suitable mixture. The plantations will be done through the agency of ponamdars if possible ; otherwise departmentally	315 & 316	118
(xiii) Up to 25 per cent of the area of the annual coupe in the Kuttalam and Ayyanarkoil Felling Series will be regenerated by the Walayar method, i.e., by stump-planting with teak at an espacement of 12 feet by 12 feet all coppice of valuable timber species being preserved	318	119
(xiv) Climber cutting will be done in the first three coupes of the Padarmalai and Kuttalam Felling Series in the second and fifth year after felling and a decision arrived at in the eighth year of the Working Plan period as to whether the operation should be extended to other coupes or discontinued	323	120
(xv) In the fifth year after formation, the areas treated under the Walayar system will be thinned if necessary	324	120
(xvi) Four salient corners of each coupe will be demarcated by cut stone slabs showing year of working and coupe number ..	326	121
(xvii) All fuel coupes will be closed to grazing for a period of 10 years after felling. The coupe under working will also be closed to grazing	327	121
(xviii) All fire-burnt areas will be closed to grazing. Where young regeneration areas are burnt the District Forest Officer will order the cutting back of all damaged regeneration if such a step appears necessary	328	121
(xix) Charcoal burning will be permitted not more than two pits on any one acre being allowed	330	122
(xx) Strobilanthes in the annual coupe will be cut below prop or stilt roots and burnt in patches by contractor	332	122
(xxi) Beats for sambur, it is suggested, will be organized by the District Forest Officer on the Mundanthorai plateau periodically with the object of minimizing sambur damage to teak coppice. The previous sanction of the Chief Conservator should be obtained	333	122
(xxii) Record of yield to be maintained	334	122
8. *The Fuel Working Circle* consists of all accessible deciduous forest capable of growing fuel on a 30-year rotation—		
(i) The working circle has been divided into 22 felling series ..	340	124
(ii) The silvicultural system will be the simple coppice system ..	342	124
(iii) The rotation will be 30 years	343	125
(iv) The yield will be regulated by area	344	125
(v) The annual coupe will be surveyed and demarcated in accordance with the felling series map by cut lines 10 feet wide by Range Officer. District Forest Officer to check 50 per cent of surveys	346	126
(vi) Each coupe to be divided into not less than three strips ..	347	126
(vii) Indicator areas to be felled by lessees	348	126

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(viii) Extraction to be through the agency of contractors ..	349	126
(ix) Disposal of arrear areas	350	126
(x) Reserved species	351	126
(xi) Fellings to proceed strip by strip ; felling rules are given in paragraph 352. All small timber to be hammer-marked before removal by beat Guard who will maintain an account. Range Officers to send monthly abstracts of these accounts to District Forest Officer	352 & 354	127
(xii) The method of regeneration will be by rab sowings of fuel species in broken lines 1 (one) chain apart over an area not exceeding 25 per cent of annual coupe. The operation to be done in August–September and in April-May	357–360	128 & 129
(xiii) Four salient corners of each coupe to be demarcated by cut stone slabs showing coupe number and year of working ..	364	130
(xiv) All fuel coupes will be closed to grazing for a period of 10 years after felling. In addition the coupe under felling will also be closed	365	130
(xv) All fire burnt areas to be closed to grazing. Where young regeneration areas are burnt the District Forest Officer will order cutting back of damaged regeneration where necessary.	366	130
(xvi) Charcoal burning at the rate of two pits on any one acre will be permitted	368	130
(xvii) Strobilanthes will be cut below the prop or stilt roots and burnt in patches by lessee	370	130
(xviii) Record of yield	371	130
9. *The Clear Felling Working Circle* consists of semi-deciduous forest suitable for conversion into teak plantations and also of all existing and future teak plantations—		
(i) Only one felling series is formed	378	131
(ii) All plantations to be of regular shape and bounded by a 12 feet wide belt of the existing forest	380	132
(iii) The silvicultural system will be clear felling and stump planting with teak and a mixture of *Dalbergia latifolia*, *Pterocarpus marsupium* and *Balanocarpus utilis*	382 & 383	132
(iv) A tentative rotation of 40 years is prescribed	384	132
(v) The annual coupe of 20 acres will be sold to a contractor in December and the latter will fell and remove produce, burn unsaleable material and hand over the area in a state fit for planting by 31st of succeeding March	387	133
(vi) The area will be stump-planted with teak at an espacement of 6 feet by 6 feet early in May	392–394	134
(vii) Introduction of other species	395	134
(viii) Every effort should be made to ensure full stocking in the year of formation	396	134
(ix) Casualties to be replaced during the second year if essential. If casualties exceed 15 per cent in third year the Conservator's orders should be obtained	397	135
(x) Planting to be done by ponamdars—Kanis free of cost ..	399	135
(xi) *Nursery work*—the method of notching out of germinating seed to be adopted	400–408	135–136
(xii) Weedings to commence immediately after completion of planting and be conducted progressively till the end of October. Casualties to be replaced simultaneously. Work to be done by ponamdars	411	137
(xiii) Two weedings in April and October in the second year are prescribed. All damaged teak to be cut back	411 & 412	..
(xiv) No weeding normally necessary in the third year	411	..
(xv) Pruning to be done if necessary during the third year ..	412	..
(xvi) Cleanings to be done in the fifth year	..	
(xvii) Thinnings in accordance with tabular statement paragraph 416 to be marked by District Forest Officer. Thinnings rules are given in	414	137
A thinning cycle of five years will be adopted	415	138
(xviii) All plantations to be closed to grazing. The merits of wire fencing as a preventive to browsing by sambur will be considered	418	139
(xix) All fungus attacked trees to be felled and removed during thinnings	420	139
(xx) Departmental plantations should be undertaken in case ponamdars are not available ; the costs are estimated to be Rs. 25 per acre	421 & 422	..

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10. *The Sandalwood Working Circle* comprises the whole of the sandal bearing areas in the division—		
(i) Only one felling series is constituted	425	140
(ii) Extraction will be limited to dead trees and will be conducted in accordance with the sandalwood extraction rules. The yield will be regulated by area	431 & 436	142–143
(iii) The felling cycle will be three years	433	142
(iv) Regular extraction will be done in the Alagarkoil sandal felling series. Periodical extraction on a three-year cycle will be done in the Kuttalam sandal felling series—		
Occasional extraction involving the extraction of all dead trees wherever noticed in the other sandal areas will be done	435	143
(v) Extraction will be done departmentally	437	143
(vi) All final cleaned wood will be sent to Tiruppattur sale depot for sale	440	143
(vii) The tending cycle will be three years. Tending rules are prescribed	443 & 444	144
(viii) Propagation centres will be established in non-sandal forest outside the Timber cum Fuel and Fuel Working Circles ..	447	144 & 145
(ix) Strip regeneration on an experimental scale of two acres per annum will be done in Alagarkoil valley	447	145
(x) Dibbling in bushes is suggested in Alagarkoil valley over as large an area as can be conveniently tackled	447	146
(xi) Only local seed to be used in regeneration operations as a precaution against introducing spike disease	448	146
(xii) The whole of the working circle with the exception of regeneration areas to be opened to grazing	449	..
(xiii) Retail sale of sandal provided for	451	..
(xiv) Artificial boundaries of sandal blocks to be cleared ..	452	..
11. *The Grazing Working Circle* includes all the accessible deciduous forest where grass is available, with the exception of areas closed for silvicultural reasons or reserved as bison sanctuaries—		
(i) The range will be the unit of grazing for control purposes ..	458	148
(ii) Grazing will be regulated by issue of permits at uniform rates for the whole division	460	149
(iii) The grazing year will be from 1st July to the succeeding 30th June	461	149
(iv) Penning to be permitted on payment and under restrictions.	462, 463	..
(v) Closure of burnt areas on silvicultural grounds to be effected.	465	..
(vi) The treatment of semi-wild cattle	471	151
12. *The Minor Forest Produce Working Circle* includes the whole division—		
(i) The produce will be sold in 36 lease units	474	153
(ii) The collection of minor forest produce will be by contract agency ; but, departmental extraction is provided for under certain contingencies	475	154
(iii) The period of lease will be one year from 1st July	477	..
(iv) One hundred tamarind plants will be planted annually on either side of all main roads and cart-tracks in deciduous forest in each beat by subordinates	479	..
(v) The minor forest produce lessees' coolies will be permitted to collect dammar from *Canarium strictum* for a period of three years and the results will be recorded	480	..
(vi) The beat Guards in four beats will be encouraged to plant as many seedlings or stump plants of *Terminalia chebula* along selected bridle-paths	481	155
13. *Miscellaneous prescriptions common to all Working Circles*—		
(i) *Fire protection.*—The common boundary between Government Forests and State or Zamin Forests will be fire traced annually in January to a width of 60 feet	488	157
(ii) All frequented paths and roads will be fire traced annually by 15th February. The District Forest Officer is given discretion to modify prescription with the approval of territorial Conservator.	489	157
(iii) Interior fire lines for the protection of catchment areas or sandal areas are prescribed	490	158
(iv) Fire patrols will continue to be employed for the minimum period necessary	491	..
(v) Fire fighting measures are prescribed	492	159

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(vi) List of roads requiring annual maintenance	496	160
(vii) All other roads and paths to be maintained by subordinates ordinarily	497	..
(viii) Stone causeways to be built across the Serviar and Kariar rivers	498	161
(ix) The possibility of converting the bridle path from Mudalaruppan to Sengalteri into a cart-track to be investigated ..	498	..
(x) Short lengths of feeder cart-tracks in the Evergreen Timber Working Circle to be constructed where necessary . ..	498	..
(xi) All buildings to be kept in a state of repair. A minimum scale of furniture for all rest-houses to be standardized and deficiencies supplied. Pit latrines to be provided where necessary ..	499	..
(xii) An inspection shed to be constructed in Ammankoil valley in Srivilliputtur Range. Motor sheds to be provided in all rest-houses accessible to cars	500	..
(xiii) The revenue survey boundary to be kept clear of all growth to a width of 15 feet by the respective beat subordinates. All changes in boundary to be recorded in the District Forest Office	503	162
(xiv) Rain gauge readings to be recorded weekly during May and July and October to January and monthly during the rest of the year	504	162
The Kalivelipil gauge to be shifted to Kariar	504	..
The Taravittanparai gauge to be shifted to Sivanaperi ..	504	..
New rain gauges to be installed in the Kodamady Ar valley and at Nazareth rest-house	504	..
(xv) It is recommended that in all rest-houses supplied with wells, pumps should be installed and wells covered, and the District Board addressed for a contribution	506	..
(xvi) A register of deviations should be maintained in the forms given	507	..
14. *The Afforestation Working Circle* covers the whole of the Kudiramozhi Teri Reserve—		
(i) It is divided into eight blocks	509	163
(ii) Rectangular plots, 4 chains wide from east to west and up to five acres in extent will be planted up as follows :—		
Dodonea viscosa and prickly-pear in alternate lines 50 feet apart	518	166
Albizzia lebbek, Acacia planifrons, Azadirachta indica and *Dalbergia multiflora* between the lines at an espacement of 12 feet by 12 feet. The method of regeneration to be left to discretion of District Forest Officer in consultation with Provincial Silviculturist	518	..
(iii) Boundaries of the above plots to be planted up with cuttings of *Ficus bengalensis* and *Odina Wodier* spaced 1 chain apart. The operation to be completed by 1st November	518	..
(iv) Five-acre plots in Kachinavilai block to be planted up annually with Cashew at an espacement of 24 feet by 24 feet.	518	167
(v) One hundred acres a year in Teri block V, to be planted up with palmyra	518	..
(vi) Casualties to be replaced in the second-year early in November in the fuel and cashew plantations	521	168
(vii) Tending suggested	522	..
(viii) Main rights of way in the Teri to be planted with banyan and *Odina wodier* cuttings, 1 chain apart on either side by beat Guards at the rate of ½ a mile annually	523	..
(ix) The area to be reserved in Nazareth and Semmarikulam blocks will be distributed over palmyra lease units detailed in paragraph 510 according to the convenience of prospective lessees who should be consulted by District Forest Officer ..	524	..
(x) The period of palmyra leases will be three years	525	..
(xi) The conditions of palmyra leases are given	526	..
(xii) A weathercock should be installed in Nazareth rest-house to record wind direction	528	169
15. *Miscellaneous Prescriptions*—		
(i) Attempts will be made by District Forest Officer to induce pattadars to sell their dead sandal trees to us for extraction the rate of payment being decided by the territorial Conservator ..	532	170
(ii) *Bamboo working*—		
(*a*) The felling cycle will be three years	534	171
(*b*) Working will be by contract agency	534	..

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(c) All one-year old culms and at least 8 year older culms in each clump will be reserved	534	..
(d) When gregarious flowering is observed, the whole area will be sold in auction felling restrictions being removed	534	..
(e) Any of the small bamboo areas mentioned in paragraph 532 may be put up for auction by the District Forest Officer if he is satisfied that they are exploitable and a demand exists. The felling cycle will be three years	534	..
(iii) *Bamboo regeneration—*		
(a) *Bambusa arundinacea* will be stump planted on an area of 5 acres annually on the Aladiyur plateau at an espacement of 33 feet by 33 feet in April and May. The Provincial Silviculturist to be consulted on the best method of propagation	536	172
(b) This bamboo may be introduced elsewhere with the previous approval of the territorial Conservator	536	..
(c) *Dendrocalamus strictus.* It is suggested that 5-acre plantations of this bamboo be raised annually by the Sengalteri beat Guard in his beat	537	172 & 173
(iv) *Valliyur Reserve—*		
(a) Two-acre experimental plantations of *Albizzia lebbek* and Cashew and *Pterocarpus marsupium* and Cashew will be established annually along the Valliyur channel	540	173
(b) The method of introduction is left to the discretion of the District Forest Officer who will consult the Provincial Silviculturist in the matter	542	173
(c) The results will be reviewed after five years and an increased area of the most successful species or mixture of species taken in hand with the previous approval of the territorial Conservator	544	173
(d) The whole reserve will remain closed to grazing but fodder grass removal will be permitted free of charge	545	173
(v) *Manure leaf—*		
(a) Pending further orders of Chief Conservator of Forests, the forests of Srivilliputtur Range will be closed to manure leaf removal	547	174
(b) The forests of Nanguneri Range will be open to manure leaf removal for a period of three years up to 31st March 1936, the seigniorage rate being 4 annas per headload. The question of closure will be examined in December 1935 and a report to Chief Conservator of Forests submitted in January 1936 ..	547	174
(c) List of species removable for manure	548	174
(vi) Preservation of game	551	175
16. *Establishment and Labour—*		
(a) The Kodamady and Kannikatty Ranges will be amalgamated to form the Ambasmudram Range	552	176
(b) The Srivaikuntam Range will be combined with the Nanguneri Range. The amalgamation is subject to revision after five years.	552	176
(c) The Ambasamudram Range will be provided with an assistant, if departmental working of the coupes in Ambasamudram Evergreen Timber Felling Series is decided upon	552	176
(d) An additional Forester will be allotted to Nanguneri Range ..	555	176
(e) The number of beats has been reduced to 51 and the number of special duty guards to two. The District Forest Officer will be permitted with the previous approval of territorial Conservator to increase the number of beats or alter their boundaries provided the sanctioned strength of 58 guards is not exceeded ..	556	176
(f) Each beat guard should be supplied with a plan of his beat on a scale of 1 inch to 1 mile	556	176
(g) Bungalow watchers will continue to be employed as at present.	557	177

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In preparing and checking control returns the following points require special attention—		
The Agricultural Commission's proposals—		
Experimental introduction of fodder grasses	251	99
Free removals of fodder grass	252	100
Removals of brushwood to assist the jaggery industry	255	100
The Evergreen Timber Working Circle—		
Canarium strictum for Kolar Gold Fields	264	104
Consult territorial Conservator before raising girth limits	264	105
Consult Chief Conservator before reducing girth limits	264	105
Demarcation of timber coupe	269	105
Coupe maps on a scale of 16 inches to one mile to be made	270, 291	106 & 111
Not more than three trees on any one acre to be marked	270	106
Large climbers to be cut	270	106
Charcoal burning to be permitted in certain gaps. Results to be reviewed in 1939–40	272	106
Natural regeneration to be tended	274	107
Provincial Silviculturist to be consulted on nursery practice	277	108 & 109
Artificial regeneration to be done	275, 276	107 & 108
First year tending	279	109
Second year tending	280	109
Record of outturn to be made	283	110
Experimental evergreen plantations to be made	285	110
Statistics of unsoundness to be maintained	289	111
Working circle maps on 4 inches to 1 mile scale to be posted	291	111
The Timber cum Fuel Working Circle—		
Annual coupes to be demarcated and surveyed	301, 302 326	113 & 114 121
Indicator area measurements to be recorded	303	114
The period of working is the official year	304	114
Coupe arrears to be disposed of	305	114
Strobilanthes to be eradicated	307, 332	115 & 122
Up to 25 per cent of the annual coupe to be artificially regenerated in two instalments	314	117
A ten-acre ponam teak plantation in Kuttalam Felling Series to be made with stump plants	316	118
Second year weeding to be done	317	118
Up to 25 per cent of the annual coupe in Kuttalam and Ayyanarkoil Felling Series to be planted with teak stumps under the Walayar System	318	118
Replacement of casualties to be made	321	120
Weeding to be done	322	120
Climber cutting to be done	323	120
Thinnings to be done	324	120
Teak plantations to be excluded under the Clear Felling Working Circle	324	120
Coupes to be closed to grazing for 10 years	327	121
Closure of fire burnt areas to be enforced	328	121
Charcoal burning is permitted	330	122
Records of yield to be maintained	334	122
Control maps on 4 inches to 1 mile and 16 inches to 1 mile scale respectively to be maintained	336	123
The Fuel Working Circle—		
Annual Coupes to be demarcated and surveyed	346, 347 364	126 130
Indicator area measurements to be recorded	348	126
The period of working is the official year	349	126
Coupe arrears to be disposed of	350	126
Strobilanthes to be eradicated	352, 370	127 & 130
Up to 25 per cent of the annual coupe to be regenerated in two instalments	360	129
Experiments on pretreatment of seed to be made	361	129
Replacement of casualties to be made	362	129
Weeding to be done	363	129
Coupes to be closed to grazing for 10 years	365	130
Closure of fire-burnt areas to be enforced	366	130
Charcoal burning is permitted	368	130
Records of yield to be maintained	354, 371	127 & 130
Control maps on 4 inches to 1 mile and 16 inches to 1 mile scale respectively to be maintained	374	131

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The Clear Felling Working Circle—		
Plantation area to be surveyed and demarcated	386	133
Clear felling and burning to be done by contractor	387	133
Teak stumps to be used at an espacement of 6′ × 6′	393	134
Early planting advocated	394	134
Casualties to be replaced	396	134
Planting and weeding to be done by ponamdars	399, 411	135 & 137
Nursery practice	400–410	135 & 136
Second-year weeding to be done departmentally	411	137
Third-year weeding to be done if necessary	411	137
Cleanings in fifth year to be done if necessary	413	137
Thinnings to be done	414, 416	137 & 138
All plantations to be closed to grazing	418	139
Departmental plantations to be made if ponamdars fail	421	139
Control map on a scale of 16 inches to 1 mile to be prepared	423 (*d*)	139
The Sandalwood Working Circle—		
Only dead trees to be extracted	431, 436	142 & 143
Extraction is to be departmental	435, 437	143
Tending is to be done	427, 443, 444	141 & 144
Propagation centres are to be established	447 (*b*)	145
Experimental strip regeneration is to be done	447 (*c*)	145
The working circle to be open to grazing	449	146
Artificial boundaries of sandal blocks to be cleared	452	146
Retail sales of sandal will be effected	451	146
Control map on a scale of 16 inches to 1 mile to be maintained	453 (*e*)	146
The Grazing Working Circle—		
Grazing to be on the permit system	460	149
Grazing year to start from 1st July	461	149
Penning to be permitted	463	149
Closure of burnt areas to be enforced	465	149
Treatment of semi wild-cattle	471	151
A control map on 1 inch to 1 mile scale to be prepared	472 (*c*)	152
The Minor Forest Produce Working Circle—		
Division into farms or lease units	474	153
Each unit to be sold in auction	475, 476	154
The period of lease is one year from 1st July	477	154
Experimental collection of dammar is to be done	480	154
Artificial introduction of *Terminalia chebula* to be done	481	155
Miscellaneous regutations—		
State or zamindari fire lines to be maintained	488	157
Roads and paths to be fire traced	489	157
Interior fire lines to be maintained	490	158
Fire patrols to be employed	491	158
Fire maps on 1 inch to 1 mile scale to be maintained	494 (*b*)	159
All roads and bridges to be kept in repair	495, 496, 497	160, 160
New constructions to be effected	498	161
All buildings to be kept in repair	499	161
New constructions to be effected	500	161
Reserve boundaries to be kept cleared	503	162
Rain gauges to be maintained	504	162
The Afforestation Working Circle—		
Experimental fuel plantations to be established	518	166
Experimental Cashew plantations to be established	518	167
Palmyra plantations to be formed	518	167
Nurseries to be formed	520	168
Casualties to be replaced	521	168
Avenues to be established	523	168
Period of palmyra leases to be 3 years	525	168
Erection of a wind vane at Nazareth to be done	528	169
Control map on 4 inches to one mile scale showing regeneration areas to be maintained	530	169

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Miscellaneous prescriptions —		
Pattadars to be induced to sell dead sandal to us	532	170
Bamboo explanation to be done	534	171
Bamboo regeneration to be done	535, 536, 537	171 and 172
Experimental explantations in Valliyur Reserve to be done	540	173
Tending to be done	543	173
The Valliyur Reserve to remain closed to grazing	545	173
Manure leaf removals to be restricted	547	174

APPENDIX I.

Annual rainfall statement—Tinnevelly division.

Serial number and name of station.	Elevation in feet.	Annual rainfall in inches.															Average of fifteen years.
		1917.	1918.	1919.	1920.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1 Athithondu	500	28·80	32·60	48·39	47·19	36·55	47·90	35·30	58·70	37·55	54·30	40·90	42·62	51·70	89·10	46·00	46·506
2 Mudaliaruthu	4,000	51·50	46·70	67·40	41·20	42·40	55·30	41·24	57·50	43·40	43·70	58·70	43·82	62·30	84·50	54·40	52·937
3 Mudangiar	300	37·93	39·86	52·25	46·35	38·72	34·67	42·70	56·80	29·42	35·00	26·60	24·75	35·30	45·12	36·97	38·829
4 Sengalmari	714	29·46	45·40	54·20	50·09	51·06	46·62	46·40	40·59	44·30	36·80	52·15	42·98	44·91	28·34	40·52	43·588
5 Kuttalam	700	51·00	71·60	67·40	69·50	43·00	77·20	78·06	120·00	89·00	80·10	56·20	73·80	87·40	48·00	77·40	72·644
6 Thirthakarai	850	58·25	61·70	96·70	82·30	87·10	77·25	90·25	86·90	74·60	71·55	70·07	87·40	108·60	87·80	92·90	82·224
7 Mundanthorai	655	42·70	70·28	63·10	60·38	55·60	65·40	53·45	104·05	96·45	66·90	66·60	78·46	54·40	65·42	61·30	66·966
8 Taraiettanparai	746	39·89	46·77	42·98	38·41	35·40	46·36	51·69	75·64	105·36	41·81	40·23	36·02	20·30	40·51	53·20	47·638
9 Kannikatty	2,550	130·40	96·98	139·40	104·00	94·00	86·60	187·20	72·25	171·40	135·25	114·64	82·76	151·84	102·86	136·82	120·426
10 Kalivelipil	4,040	96·47	80·85	147·30	130·26	88·65	151·50	270·10	146·70	211·12	207·60	226·22	298·63	176·65	251·31	378·84	190·813
11 Kuduvarai	1,036	87·27	88·48	97·77	96·99	79·46	74·35	93·80	135·75	89·30	106·86	110·53	109·07	111·84	82·96	128·30	99·515
12 Kuttalam Kalaruvi	2,156	92·36	105·47	110·37	116·68	92·72	73·82	85·33	171·65	116·27	132·65	121·72	114·61	144·34	102·80	169·65	116·696
13 Sengalteri	3,151	55·60	43·80	64·50	58·00	64·80	73·60	98·85	105·32	139·52	63·70	87·60	75·95	105·80	81·20	93·20	80·762

APPENDIX II.

Botanical list of trees with times of flowering and seeding.

Botanical name.	Tamil name.	Time of flowering.	Time of fruiting.
Abrus precatorius	Kundumani	....	....
Acacia concinna	Sheyakkai	....	....
Acacia ferruginea	Sinnei velvel or Karambai.	....	May.
Acacia latronum	Karodai or Kakaodai	....	February.
Acacia leucophlœa	Velvel	January	April—June.
Acacia pennata	Vellai Indu	....	....
Acacia planifrons	Odai	February	April—June.
Acacia sundra	Karungali	....	....
Acrocarpus fraxinifolius	Malankonnei	February	April—May.
Adina cordifolia	Manjakadambei	November	....
Ægle marmelos	Vilvam	....	....
Aglaia courtallensis	Vegula chokla	....	....
Aglaia minutiflora	Piramuttipala	....	....
Aglaia roxburghiana	Chokla	April—May	January.
Agrostistachys longifolia	Manikulikki	....	....
Agrostistachys meeboldii	....	....	....
Ailanthus excelsa	Peemaram	March	....
Ailanthus malabarica	Mattipal	....	....
Alanguim lamarckii	Allinji	....	May.
Alanguim salvifolium	....	....	....
Albizzia amara	Usil	July	December—January.
Albizzia lebbek	Vagai or Panni vagai.	January	March—April.
Albizzia odoratissima	Chithala vagai	May	December—January.
Albizzia procera	Velvagai	....	December—January.
Albizzia stipulata	Nirusil	....	....
Alphonsea zeylanica	....	February—April	October—December.
Alstonia scholaris	Ezhilaipalai	....	....
Amoora canarana	Kara agil	....	....
Anacardium occidentale	Munthrikottai	....	....
Anacolosa densiflora	Kalmanikkam	....	....
Anogeissus latifolia	Vekkali	....	July—August.
Anogeissus pendula	Naman	....	....
Anthocephalus cadamba	Kola auila	....	....
Antiaris toxicaria	Maravuri	....	July—August.
Aporosa acuminata	Nirvetti	....	....
Arenga wightii	Alampanei	....	....
Artocarpus hirsuta	Aiyini pila	....	September—October.
Artocarpus integrifolia	Pila	....	....
Atalantia monophylla	Malanarathei	....	....
Azadirachta indica	Vembu	March	August.
Baccaurea courtellensis	Thonthi	....	....
Balanocarpus utilis	Karunkongu	March—May	October—November.
Balsamodendron berryi	Mulkiluvai	....	....
Bambusa arundinacea	Moongil	....	....
Bassia longifolia	Katillupai	....	October.
Bauhinia malabarica	Vellathi	....	....
Bauhinia racemosa	Athi	....	....
Bauhinia tomentosa	....	....	....
Bentinckia coddapanna	Kanthapanei	....	....
Bischofia javanica	Milachadayan	February—March	February—March.
Bombax malabaricum	Muliluvai	....	May—July.
Borassus flabelliformis	Panei	....	....
Bridelia retusa	Adamaruthu	....	January.
Buchanania latifolia	Madama or Kattuma.	....	May.
Butea frondosa	Porasu	March	....
Cadaba trifoliata	....	....	May.
Caesalpinia sappan	Sappan	May	....
Calamus rotang	Porambu	....	....
Calophyllum elatum	Pinnei	....	....
Calophyllum inophyllum	Punnamkottei	....	....
Calophyllum trapezifolium	Cherupennei	August	December—January.
Canarium strictum	Karumkunthrikam	March	....
Capparis horrida	....	....	....
Carallia integerrima	Andimirian	....	....
Careya arborea	Ayma	May	....
Carissa carandas	Kelakai	....	....
Caryota urens	Koondapanei	....	....
Cassia auriculata	Avaram	....	....
Cassia fistula	Konnai	March—April	March—May.
Cassia siamea	Manjakonnei	....	December—January.
Cedrela toona	Santhana vembu	January—February.	April—July.
Celtis wightii	....	....	....
Chloroxylon swietenia	Vaimara	May—June	May—June.
Chukrasia tabularis	Madagiri vembu	October	February—May.
Cinnamomum gracile	....	....	....
Cinnamomum zeylanicum	Lavangam	....	....
Clausena indica	....	....	....
Clausena willdenowii	Kattuveppilai	....	....
Clerodendron infortunatum	....	August	....
Cochlospermum gossypium	Tanuku	....	....
Combretum ovalifolium	Odankodi	....	....
Cordia myxa	Virusham	....	July—August
Cratæva religiosa	Mavalingam	....	....
Croton malabaricus	Thavattupulavu	....	....
Cullenia excelsa	Vedipila	May	October.

Botanical list of trees with times of flowering and seeding—cont.

Botanical name.	Tamil name.	Time of flowering.	Time of fruiting.
Dalbergia latifolia	Thothagathy	April—May	February—March.
Dalbergia multiflora	Viruvatte	February	June.
Dalbergia paniculata	Adukkuvagoi or Pachela.	....	....
Dichrostachys cinerea	Vadathalai	November	....
Dillenia pentagyna	Nai Teku	....	....
Diospyros assimilis	Karunthalu	....	....
Diospyros bourdilloni	Karumthovarai	....	....
Diospyros embryopteris	Panichi	....	....
Diospyros foliolosa	Vella thovarai	....	....
Diospyros insignis	Do.	....	....
Diospyros microphylla	Chinna thovarai	....	....
Diospyros montana	Vakkanai	....	....
Diospyros orixensis	Vellei thovarai	....	....
Dipterocarpus bourdilloni	Karanjili	....	....
Dodonœa viscosa	Virali	....	....
Dolichandrone crispa	Pumpadri	....	June—July.
Dysoxylum malabaricum	Vellagil	February—March	....
Dysoxylum beddomei	Chinnagil	....	....
Ehretia lœvis	Nariveli	....	....
Elœocarpus oblongus	Athankottei	....	....
Elœocarpus serratus	Olankarei	April	July.
Elœocarpus tuberculatus	Ruthracham	April	....
Elœodendron glaucum	Karei	....	December—May.
Eriodendron anfractuosum	Ilavam	....	....
Erythrina indica	Mullumurukku	....	March—May.
Erythroxylon monogynum	Shemmanathi	June	December.
Eugenia gardneri	Nirnaval	....	....
Eugenia jambolana	Naval	June	August—September.
Eugenia læta	....	....	....
Eugenia munronii	....	March—April	November—December.
Eugenia zeylanica	....	May	....
Euphorbia tirucalli	Tirukalli	....	....
Evodia roxburghiana	Kattuchampakam	....	....
Feronia elephantum	Vilamaram	....	....
Ficus asperrima	Iramparathan	....	....
Ficus bengalensis	Ala	....	....
Ficus religiosa	Arasu	....	....
Filicium decipiens	Athuadali	January—February	April.
Flacourtia sepiaria	....	....	April.
Garcinia cambogia	Kodukapuli	....	....
Garcinia echinocarpa	....	....	....
Garcinia morella	Makki	....	....
Givotia rottleriformis	....	....	....
Gluta travancorica	Senkurinji	January—April	May—June.
Glycosmis pentaphylla	Kulapanei	....	....
Gmelina arborea	Kumil	....	September—October.
Gmelina asiatica	Kumil	....	....
Gordonia obtusa	....	May	....
Grewia asiatica	....	....	August.
Grewia hirsuta	Kallunnu	....	....
Grewia lævigata	Unnu	August	September—December.
Grewia leptopetala	Do.	....	....
Gyrocarpus jacquini	Tanuku	....	....
Hardwickia binata	Acha	....	....
Hardwickia pinnata	Kolavu	....	December—January.
Hardwickia wightiana	....	....	....
Harpullia cupanioides	....	....	July.
Helicteres isora	Valamburi	March	....
Hemicyclia venusta	Vellelembu	....	....
Hemigyrosa deficiens	....	....	....
Heritiera papilio	Sadanangu	....	July.
Hippocratea indica	Morusarakodi	....	June.
Holarrhena antidysenterica	Kodagapala	....	....
Holigarna arnottiana	Kattecherei	....	....
Holoptelea integrifolia	Ayili	....	....
Hopea parviflora	Kongu	March—May	July—August.
Hydnocarpus alpina	Maravetti	....	July—August.
Hugonia mustax	....	December	August.
Ixora parviflora	....	....	....
Lagerstrœmia lanceolata	Ven Teku	....	....
Lansium anamalayanum	....	....	....
Lantana sp.	Arippu	....	....
Laportea crenulata	Anachoriyan	....	....
Leea sambucina	....	....	....
Lepisanthus tetraphylla	....	....	May—November.
Litsœa zeylanica	Shembagapalai	....	....
Lophopetalum wightianum	....	....	....
Maba buxifolia	Irambali	....	....
Macaranga roxburghii	Vattakanni	....	....
Machilus macrantha	Kolamavu	....	....
Mallotus philippinensis	Thavattai	....	September—October.
Mangifera indica	Maa	April	July—August.
Mappia fœtida	Arali	....	....
Meliosma arnottiana	Kusavi	....	....
Memecylon gracile	....	May	....
Mesua ferrea	Siru nangu	June	November—December.
	Peria nangu	July	Do.
Michelia champaca	Champakam	....	....
Miliusa roxburghiana	....	August	....
Mimusops elenji	Mahilamaram	....	....
Mimusops hexandra	Olakapalei	March	....

Botanical list of trees with times of flowering and seeding—cont.

Botanical name.	Tamil name.	Time of flowering.	Time of fruiting.
Mitrephora heyneana	....	June	....
Morinda citrifolia	Manjanathi	May	....
Morinda tinctoria	Do.	....	....
Moringa pterygosperma	Muringa	....	....
Mundulea suberosa	Pullavaram	July	....
Murraya exotica	Kattukaruveppilai	May	....
Myristica beddomei	Kattujathikai	....	....
Myristica magnifica	....	....	....
Myristica malabarica	....	March	September.
Nephelium longana	Kattupuvan or shenpuvan.	....	May—October.
Niebuhria linearis	....	August	....
Nothopegia colebrookiana	Sorapalai	..	....
Ochlandra brandisii	Eeta	....	....
Ochlandra travancorica	Eeta	....	....
Odina wodier	Kaka usil	March	....
Ormosia travancorica	Maleimanjadi	March	April—June.
Palaquium ellipticum	Palvadinjan	....	....
Pandanus tectorius	Talai	....	....
Pavetta indica	Pavetta	....	....
Phœnix farinifera	Eacham	....	....
Phœnix sylvestris	Do.	....	....
Phyllanthus emblica	Nelli	....	April—October.
Pinanga dicksonii	Kana kamuku	....	....
Plectronia didyma	Irambarathan	....	....
Podocarpus latifolia	Neerambuli	....	February—March.
Pœciloneuron indicum	Puthangali	....	....
Pœciloneuron pauciflorum	Do.	March—June	November—December.
Polyalthia cerasoides	Nedunar	May	December—January.
Polyalthia longifolia	Netteilingam	....	....
Polyalthia fragrans	Nedunar	....	....
Pongamia glabra	Pungam	....	....
Premna tomentosa	Kolakkattei Teku	....	....
Prosopis spicigera	Parambai	....	....
Protium caudatum	Pachakiluvai	May	....
Pterocarpus marsupium	Vengai	July—August	March—April.
Pterolobium indicum	Kar indu	....	....
Pterospermum glabrescens	Vattapolavu	....	....
Pterospermum rubiginosum	Chithalai polavu	....	....
Pygeum wightianum	Attanari kongu	January	October—November.
Randia dumetorum	Karai	....	....
Sansevieria zeylanica	Marul	....	....
Santalum album	Santhanam	April—August	May and December.
Sapindus emarginatus	Neikottai	....	....
Schleichera trijuga	Poovan	....	....
Semecarpus anacardium	Sheran kottai	....	February—May.
Spondias mangifera	Ambalam	....	....
Stephegyne parvifolia	Nir kadambai	July	....
Sterculia guttata	....	....	....
Sterculia urens	Senthanuku	March	....
Stereospermum chelonoides	Poompathiri	....	....
Streblus asper	Pira	....	....
Strobilanthes sp.	Kurinja	....	....
Strychnos nuxvomica	Etti	....	....
Strychnos potatorum	Thettankottai	....	....
Tamarindus indica	Puli	September—October.	April—May.
Tectona grandis	Tekku	July—October	January—April.
Terminalia arjuna	Kolamaruthu	....	....
Terminalia belerica	Tani	July	....
Terminalia chebula	Kadukkai	July—August	January—March.
Terminalia paniculata	Karimaruthu	December	April—May.
Terminalia travancorensis	Pei kadukai	....	....
Trema orientalis	Anparuthi	....	....
Vateria indica	Velleikunthrikam	March—April	September.
Ventilago madraspatana	Vembadam	....	March.
Vernonia arborea	....	....	February.
Vernonia monosis	Suthi		....
Vitex altissima	Mylai	May—October	October—December.
Wrightia tinctoria	Thanthapalei	February—March	July—August.
Xanthophyllum flavescens	Narathei	....	....
Zanthoxylum rhetsa	Kattu murukku	....	....
Zizyphus glabrata	Karikotte	....	....
Zizyphus jujuba	Elandai	....	....
Zziyphus œnoplia	Kottei	....	....
Zizyphus trinerva	Karukatan	....	....
Zizyphus xylopyrus	Kottei	....	....

APPENDIX III.

SANDALWOOD TRANSIT RULES FOR TINNEVELLY CUM RAMNAD DIVISION.

NOTIFICATION NO. 435, TINNEVELLY DISTRICT GAZETTE, DATED APRIL 5, 1933.

In exercise of the powers conferred by sections 35 and 36 of the Madras Forest Act, 1882 (Madras Act V of 1882), the Governor in Council is hereby pleased to make the following rules to regulate the transit of sandalwood in the revenue districts of Tinnevelly and Ramnad:—

Sandalwood Transit Rules for the Revenue Districts of Tinnevelly and Ramnad.

1. *Definition.*—In these rules, the term "Sandalwood" includes sandalwood dust and chips.

2. *Routes for import and export.*—No person shall import sandalwood into, or export sandalwood from, the revenue districts of Tinnevelly and Ramnad except by the routes specified in Schedule A.

3. *Conditions for import, export and movement.*—No person shall import sandalwood into, or export sandalwood from, or move sandalwood within, the revenue districts of Tinnevelly and Ramnad unless such sandalwood is accompanied either by the pass prescribed by rule 5 or the way pass prescribed by rule 7 and unless such sandalwood bears the mark of the Government of origin as provided in rule 9 or the property mark in respect of such sandalwood has been duly registered in accordance with that rule.

4. *Additional condition for import, of movement into certain towns or stations.*—No person shall import or move sandalwood into any of the towns or stations specified in Schedule B unless such sandalwood is also reported for examination at the appropriate checking stations specified in that schedule.

5. *Form of passes.*—(i) In the case of sandalwood purchased from Government lands and depots in the revenue districts of Tinnevelly and Ramnad the pass shall be in Form I and shall be printed.

(ii) In the case of sandalwood purchased at the Government sales in Mysore, Travancore, Coorg and British Territory, and imported into the revenue districts of Tinnevelly and Ramnad, the pass shall be that issued by the Government or administration responsible for the sales and such pass shall be valid only for transport to the destination specified therein.

(iii) In the case of imported sandalwood other than that referred to in sub-rule (ii), the pass shall be in Form II and shall be printed. It shall be supplied free of cost, on application, by the District Forest Officer, having jurisdiction.

(iv) In the case of subsequent movement of the imported sandalwood and of the transport of all local sandalwood other than that for which Form I is prescribed, a printed pass in Form II shall be used. It shall be supplied free of cost, on application, by the District Forest Officer, having jurisdiction.

6. *Issue of passes.*—(i) Passes in Form I shall be in triplicate and shall have all parts filled up by the District Forest Officer or an officer duly authorized by him. The District Forest Officer or the officer so authorized, as the case may be, shall hand over the original to the purchaser, send the duplicate to the Range Officer, and retain the triplicate as counterfoil for record in his office.

(ii) Passes in Form II shall be in triplicate and shall have all parts filled up by the person disposing of the sandalwood or his authorized agent; the original shall be handed over to the person authorized to remove the sandalwood the duplicate shall be forwarded by post or by messenger to the District Forest Officer, having jurisdiction by the person issuing the pass who shall retain custody of the sandalwood in his store or on his land for purposes of check for a period not exceeding fifteen days from the date on which the duplicate was posted to the District Forest Officer or delivered to him by messenger, as the case may be. The triplicate of the pass shall be retained by the person issuing the pass for not less than six months from the date of issue of the original of the pass and shall be produced for inspection at any time within that period on demand by any Forest Officer not below the rank of Forester.

7. *Check of passes.*—All sandalwood in transit shall be produced for examination at the first checking station on the authorized route between the hours of 6 a.m. and 6 p.m. and if such sandalwood arrives at the first checking station after 6 p.m. the officer-in-charge of the checking station may detain it till 6 a.m. following for examination.

The officer-in-charge of the checking station shall after satisfying himself that the sandalwood actually comes from the locality and is of the kind stated in the foreign Government pass or the pass in Form I or II, as the case may be, and is not in excess of the quantity specified therein, retain such pass and give in exchange therefor a way pass in Form III as hereinafter provided. If the officer-in-charge of the checking station is not so satisfied and refuses to grant the way pass he shall detain the sandalwood and the foreign Government pass or the pass in Form I or II as the case may be and report the case for the orders of the District Forest Officer, having jurisdiction, stating clearly his reasons for the action taken.

The quantity of sandalwood under transit shall not be greater than that entered in the pass and if it is less, the same pass shall not be used again to cover the deficiency.

The way pass in Form III shall be in duplicate; the original shall be given in exchange for the foreign Government pass or the pass in Form I or II as the case may be and the duplicate shall be retained by the officer-in-charge of the checking station.

The way pass shall protect such sandalwood along the route to its destination and shall be produced and endorsed at all subsequent checking stations on that route.

8. *Production of pass at the checking station.*—The foreign Government pass, the pass in Form I or II or the way pass in Form III as the case may be, shall, in the case of imported sandalwood and sandalwood for export, be produced with the sandalwood for examination at any station which may be notified from time to time by the Collector concerned in the District Gazette as a checking station and past which the sandalwood may be taken. In the case of sandalwood in transit, such pass shall be produced anywhere within the limits of the revenue districts of Tinnevelly and Ramnad when demanded by any Revenue, Forest or Police Officer and at the checking station nearest to the locality of felling and at all subsequent checking stations notified from time to time by the Collector concerned in the District Gazette and past which the sandalwood is taken.

No person shall take any sandalwood off, or pass it from, any road on which a checking station has been placed with intent to evade the production of the sandalwood at a checking station.

9. *Use and registration of property marks.*—(i) All sandalwood imported from Mysore, Travancore and Coorg and all Government sandalwood disposed of locally shall bear the mark of the Government of origin in the following manner:—

Every piece of sandalwood shall bear its own Government mark and in the case of chips and saw-dust carried in bags, the latter shall be closed and the fastening sealed with the above mark.

(ii) All other sandalwood imported into, or exported from, or moved within the areas specified in rule 3 shall be similarly indicated by a property mark affixed in the manner provided in sub-rule (i).

All such property marks shall be registered at a District Forest Office—

(*a*) in accordance with the provisions of sub-rule (iii), if the marks relate to sandalwood extracted from private lands within the said areas, and

(*b*) in accordance with the provisions of sub-rule (iv), if the marks relate to sandalwood other than that extracted from private lands within the said areas.

(iii) (*a*) (1) Every application for the registration of a property mark in respect of sandalwood extracted from private lands within the areas specified in rule 3 shall be accompanied by a statement in Form IV in which all the particulars therein prescribed shall be furnished to the District Forest Officer having jurisdiction and also by six facsimiles of the mark proposed. The form shall be supplied free of cost, on application, by the District Forest Officer.

(2) Each uprooted tree, bearing heartwood, shall be cleaned up to its heartwood limit, after leaving uncut a ring of bark and sapwood, 2 to 3 inches wide, at breast height of the tree from ground level before it was uprooted. The girth, in inches over this ring of bark shall be recorded in the statement Form IV.

(3) Every tree so uprooted and cleaned shall bear its distinctive serial number which shall be written legibly in tar anywhere on it if it has not been cut up into stem and rootwood separately. Where the tree has been cut up into billets and roots, all parts of each such tree so cut up shall bear, at their cut ends, the original serial number assigned to that tree, so as to admit of identification and check later by the District Forest Officer or by his subordinate.

(4) The exact situation of the land whence each of the heartwood containing trees was extracted shall be indicated on the ground by a stout numbered peg which shall be well driven home in the pit formed in the process of uprootal, the number on the peg being the same as that written on the wood concerned. These pegs shall be retained until such time as the District Forest Officer or his subordinate checks the sandalwood and verifies the locality of felling.

(5) The heartwood obtained from each of the uprooted trees shall thereafter be weighed and the result recorded in the statement in Form IV indicating in it at the same time the number of root and stem wood pieces obtained from each such tree, with an abstract in the "Remarks column" showing the total number of trees extracted and cleaned, their total outturn expressed in number of pieces (roots and billets separately) and the aggregate of all pieces in respect of which the registration of property mark is desired.

(6) After the application, with the statement in Form IV containing all the particulars therein prescribed is received, the District Forest Officer or an officer subordinate to the District Forest Officer who is authorized by him in that behalf shall, as soon as possible, inspect the locality of extraction and identify the sandalwood by verifying the girth and assembling all the parts of each tree and satisfy himself about the accuracy of the details furnished by the applicant. If the result of such inspection is satisfactory, the District Forest

Officer shall mark the sandalwood with the district pass hammer and subject to the provisions of clause (*b*) of this sub-rule grant a certificate of registration in Form V with as little delay as possible.

(*b*) The District Forest Officer or any officer authorized by him may require from any person, either when presenting a property mark for registration or at any subsequent time, information as to the source or origin and the quantity of sandalwood, period of felling, agency, routes, depots of destination and such other details regarding his method of felling, trading or working as the District Forest Officer may think necessary. The District Forest Officer may refuse registration and may cancel the registration of any property mark if the information required is not given, or if he considers that such property mark cannot easily be distinguished from a Government mark or from a property mark used by another person, or if he has reason to believe that the person using the property mark is or has been concerned in any illegal practice with regard to the sandalwood or for any other good and sufficient reason. The reason for such refusal or cancellation shall in every case be placed upon record by the District Forest Officer and submitted for the approval of the Collector.

(iv) (1) Every application for the registration of property mark in respect of sandalwood other than that extracted from private lands within the areas specified in rule 3 shall be accompanied by six facsimiles of the mark proposed.

(2) After the receipt of the application, the District Forest Officer, or an officer authorized by him in that behalf, shall check such sandalwood and if the result of such checking is satisfactory the District Forest Officer, shall, subject to the provision of clause (*b*) of sub-rule (iii), grant a certificate of registration in Form V, with as little delay as possible.

(3) All sandalwood in respect of which a property mark is registered under this sub-rule, shall be marked with the district pass hammer by the District Forest Officer or by an officer authorized by him to do so.

10. *The date up to which and the description and quantity of sandalwood for which registration of property mark has effect.*—The registration and each renewal of registration of a property mark shall be valid only in respect of the description and quantity of the sandalwood entered in Form V and be in force only from the date of such registration or renewal until the first day of April following, unless otherwise stated.

11. *Exemption of small quantities of sandalwood carried by* bona fide *travellers or cut by ryots for their* own use.—Nothing contained in these rules shall apply to—

(*a*) Sandalwood not exceeding 5 lb. in weight carried by any *bona fide* traveller or under his authority for his own use, or,

(*b*) sandalwood cut and carried by a ryot for his own use from trees growing on the patta lands of the said ryots or of any neighbouring ryot from whom title to such sandalwood is derived; provided that he obtains a certificate of title from the village munsif and that the quantity cut and carried on each occasion does not exceed 15 lb. in weight.

12. *Penalties.*—Whoever infringes any of the provision of these rules shall be punished with imprisonment which may extend to one month or with fine which may extend to two hundred rupees or with both.

Schedule A.

(Referred to in rule 2.)

Showing the authorized routes along which sandalwood may be exported from, or imported into, the Revenue districts of Tinnevelly and Ramnad.

Revenue District of Tinnevelly.

1. South Indian Railway line from Tuticorin to Tinnevelly.
2. Road from Tuticorin to Tinnevelly via Vagaikulam, Srivaikuntam and Palamcottah.
3. South Indian Railway line from Tinnevelly to Tiruchendur.
4. Road from Travancore to Tinnevelly via Pandakudi, Vadakkuvalliyur, Nanguneri, Munradippu and Palamcottah.
5. Road from Tinnevelly to Tenkasi via Palamcottah, Munnirpallam, Sermadevi, Ambasamudram and Kadayam.
6. Road from Kuttalam to Tenkasi.
7. Road from Kuttalam to Sivagiri via Ilanji, Nainaragaram, Kadayanallur, Chokkampatti and Vasudevanallur.
8. Road from Koilpatti to Vilattikulam via Ettayapuram.
9. South Indian Railway line from Tinnevelly to Tenkasi.
10. South Indian Railway line from Tenkasi to Sankaranayinarkoil.
11. South Indian Railway line from Maniyachi to Kovilpatti.
12. Road from Panakudi to Sermadevi via Tirukurungudi and Kalakad.

Revenue District of Ramnad.

1. South Indian Railway line from Kovilpatti to Virudunagar.
2. South Indian Railway line from Sankaranayinarkoil to Virudunagar.
3. Road from Tiruppuvanam to Ramnad and on to Rameswaram.
4. Road and railway line from Manamadura to Karaikudi via Sivaganga.
5. Road from Tiruppattur to Sivaganga via Managiri, Amaravathipudur, Devakottai, Sarugani and Kalayarkoil.
6. Road from Tiruppattur to Sivaganga via Tirukoshtiyur, Madagupatti and Sholapuram.
7. Road from Sivaganga to Tiruppuvanam.
8. Road from Manamadura to Aruppukottai via Partibanur Abiramam, Kamudi and Tiruchuli.
9. Road from Aruppukottai to Kariapatti.
10. Road from Sivagiri in the Tinnevelly district to Srivilliputtur in the Ramnad district.
11. Road from Srivilliputtur to Vartirayiruppu via Sundarapandiyam
12. Road from Srivilliputtur to Tirumangalam in the Madura district.

SCHEDULE B.

(Referred to in rule 4.)

Revenue District of Tinnevelly.

Taluk.	Town or station.	Checking station.
Srivaikuntam	Srivaikuntam	Forest Range Office.
Tinnevelly	Palamcottah	Deputy Tahsildar's Office.
Do.	Tinnevelly	District Forest Office.
Nanguneri	Nanguneri	Taluk Office.
Do.	Tirukurangudi	Section Office (Forester).
Ambasamudram	Ambasamudram	Forest Range Office, Kannikatti at Ambasamudram.
Tenkasi	Tenkasi	Taluk Office.
Do.	Kadayanallur	Forest Range Office, Kadayanallur.
Sankaranayinarkoil ..	Vasudevanallur	Section Office (Forester).

Revenue District of Ramnad.

Taluk.	Town or station.	Checking station.
Srivilliputtur	Rajapalaiyam	Police Station, Rajapalaiyam.
Do.	Srivilliputtur	Forest Range Office.
Do.	Vartirayiruppu	Section Office (Forester), Pudupatti.
Aruppukottai	Aruppukottai	Taluk Office.
Do.	Karlapatti	Police Station.
Tiruppattur	Tiruppattur	Taluk Office.
Sivaganga	Manamadura	Police Station.
Do.	Sivaganga	Taluk Office.

(Counterfoil to be retained by the issuing officer.)

FORM I.

(Referred to in Rule 5.)

Pass No.

(Under section 35 of the Madras Forest Act, 1882.)

1 Name and residence of the person to whom the pass is granted.

2 Quantity.

3 Description of sandalwood.

4 Fees paid, if any.

5 Marks, if any, on the sandalwood.

6 From what forest or depot removed.

7 To what place removed.

8 Route.

9 Time allowed.

10 Remarks.

Date.

Signature of the issuing officer.

Designation.

(Duplicate to be sent to the officer in charge of the forest.)

FORM I.

(Referred to in Rule 5.)

Pass No.

(Under section 35 of the Madras Forest Act, 1882.)

1 Name and residence of the person to whom the pass is granted.

2 Quantity.

3 Description of sandalwood.

4 Fees paid, if any.

5 Marks, if any, on the sandalwood.

6 From what forest or depot removed.

7 To what place removed.

8 Route.

9 Time allowed.

10 Remarks.

Date.

Camp.

Signature of the issuing officer.

Designation.

(Reverse.)

[To be filled in by the tanadar.]

Date and number of way-pass.

Form III in exchange for the pass.

Date. (1)	Number. (2)	Quantity. (3)

Date.

Signature of tanadar.

FORM I.

(Referred to in Rule 5.)

Pass No.

Pass for the $\frac{\text{export}}{\text{transport}}$ of sandalwood from Government $\frac{\text{lands}}{\text{depots}}$

(Under section 35 of the Madras Forest Act, 1882.)

Name and residence of the person to whom the pass is granted. (1)	Quantity. (2)	Description of sandalwood. (3)	Fees paid, if any. (4)	Marks, if any, on the sandalwood. (5)	From what forest or depot removed. (6)	To what place removed. (7)	Route. (8)	Time allowed. (9)	Remarks. (10)

Date.

Camp.

Signature of the issuing officer

Designation.

(Counterfoil to be retained by the person issuing the pass.)

FORM II.

(Referred to in Rule 5.)

Pass No.

(Under section 35 of the Madras Forest Act, 1882.)

1 Name and residence of the person to whom the pass is granted.

2 Quantity.

3 Description of sandalwood.

4 Marks, if any, on the sandalwood.

5 Whence obtained.

6 To what place removed.

7 Route.

8 Time allowed.

9 Remarks.

Date.

Station.

Signature of the person granting the pass.

NOTE.—The time to be entered in column 8 hould not exceed the period calculated at 15 miles per day except with the special permission of the District Forest Officer.

(Duplicate to be sent to the District Forest Officer.)

FORM II.

(Referred to in Rule 5.)

Pass No.

(Under section 35 of the Madras Forest Act, 1882.)

1. Name and residence of the person to whom the pass is granted.

2. Quantity.

3. Description of sandalwood.

4. Marks, if any, on the sandalwood.

5. Whence obtained.

6. To what place removed.

7. Route.

8. Time allowed.

9. Remarks.

Date.

Station.

Signature of the person granting the pass.

NOTE.—The time to be entered in column 8 should not exceed the period calculated at 15 miles per day except with the special permission of the District Forest Officer.

(*Reverse.*)

(To be filled in by the tanadar.)

Date and number of way pass.

Form III in exchange for the pass.

Date. (1)	Number. (2)	Quantity. (3)

Date.

Signature of Tanadar.

FORM II.

(Referred to in Rule 5.)

Pass No.

Pass for the import / export / transport of sandalwood from private lands or from foreign territory.

(Under section 35 of the Madras Forest Act, 1882.)

Name and residence of the person to whom the pass is granted. (1)	Quantity. (2)	Description of sandalwood. (3)	Marks, if any, on the sandalwood. (4)	Whence obtained. (5)	To what place removed. (6)	Route. (7)	Time allowed. (8)	Remarks. (9)

Date.

Station.

Signature of the person granting the pass.

NOTE.—The time to be entered in column (8) should not exceed the period calculated at 15 miles per day except with the special permission of the District Forest Officer.

(Counterfoil to be retained by the issuing officer in duplicate diglot.)

FORM III.

(Referred to in Rule 7.)

Way-pass.

(Under section 35 of the Madras Forest Act, 1882.)

No.

Pass for the transport of sandalwood from checking station brought on permit No. dated 193 .

1 Quantity.

2 Description.

3 Marks.

4 Route to be followed within the scheduled area.

5 Time allowed.

6 Remarks.

Date.

Station.

Signature of tanadar.

NOTE.—This way-pass is granted subject to the rules under section 35 of the Madras Forest Act, 1882 (Madras Act V of 1882), and must be produced on demand by any Revenue, Forest or Police officer.

FORM III.

(Referred to in Rule 7.)

Way-pass.

(Under section 35 of the Madras Forest Act, 1882.)

Pass for the transport of sandalwood from checking station brought on permit No. , dated 193 .

Quantity. (1)	Description. (2)	Marks. (3)	Route to be followed within the schedule area. (4)	Time allowed. (5)	Remarks. (6)

Date.

Station.

Signature of tanadar.

NOTE.—This way-pass is granted subject to the rules under section 35 of the Madras Forest Act, 1882 (Madras Act V of 1882), and must be produced on demand by any Revenue, Forest or Police officer.

FORM IV.

(Referred to in rule 9.)

List of sandalwood trees uprooted, numbered, cleaned and weighed which are awaiting removal from the limits of survey fields Nos. of village in the taluk, district, to depot situated in village, taluk, district.

Period of felling. (1)	Serial number of trees uprooted. (2)	Girth of tree over bark at breast height, in inches. (3)	Description and number of pieces obtained. Number of pieces. (4)		Outturn of scented wood from each tree. (5)	Remarks. (6)
			(i) Root wood.	(ii) Stem and branch wood.		
					QR. LB.	

(Counterfoil to be retained by the issuing officer in duplicate diglot).

FORM V.

(Referred to in Rule 9.)

Certificate of registration.

(Under section 35 of the Madras Forest Act, 1882.)

1 Name of person registering.

2 Description of device of property mark.

3 Description and quantity of sandalwood registered.

4 Date of registration or renewal.

5 Remarks.

Certified that residing at as registered/renewed the above device or property mark for the official year ending 31st March 193 . up to 193

District Forest Office,
193 .

District Forest Officer.

FORM V.

(Referred to in Rule 9.)

Certificate of registration.

(Under section 35 of the Madras Forest Act, 1882.)

Name of person registering. (1)	Description of device or property mark. (2)	Description and quantity of sandalwood registered. (3)	Date of registration or renewal. (4)	Remarks. (5)

Certified that residing at has registered/renewed the above device or property mark for the official year ending 31st March 193 . up to 193

District Forest Office,
193 .

District Forest Officer.

APPENDIX IV.

Statement of prices per acre obtained for fuel coupes from 1903–1932.

Serial number and name of felling series. (1)	1903. (2)	1904. (3)	1905. (4)	1906. (5)	1907. (6)	1908. (7)	1909. (8)	1910. (9)	1911. (10)	1912. (11)	1913. (12)	1914. (13)	1915. (14)	1916. (15)	1917. (16)	1918. (17)
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1 Pudupatti	..	..	..	..	5 0 0	5 0 0	4 11 0	7 8 0	..	8 4 0	9 0 0	5 0 0	4 2 0	..	3 0 0	3 3 0
2 Rengarkoil	..	..	..	..	3 8 0	3 6 0	7 14 0	..	3 8 0	4 5 0	3 4 0	3 4 0	3 14 0	4 4 0	9 14 0	6 0 0
3 Valaikulam	..	..	..	..	6 8 0	5 0 0	9 0 0	15 5 0	10 9 0	13 0 0	10 12 0	9 0 0	8 0 0	7 0 0	16 8 0	7 0 0
4 Ayyanarkoil	..	..	..	..	15 0 0	20 0 0	18 4 0	..	89 0 0	53 0 0	24 0 0	32 0 0	26 6 0	17 13 0	16 0 0	21 0 0
5 Vasudevanallur	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6 Karuppasamikoil	15 0 0	25 4 0	30 0 0	14 0 0	38 13 0	16 0 0	11 0 0	32 3 0	47 13 0	40 6 0	41 8 0	25 0 0	28 4 0	16 0 0	43 0 0	33 0 0
7 Puliarigudi	..	..	..	..	..	15 2 0	20 4 0	31 8 0	61 0 0	51 4 0	28 8 0	12 10 0	17 8 0	18 8 0	23 0 0	30 0 0
8 Kadayanallur	25 2 0	30 0 0	31 4 0	12 0 0	30 2 0	25 14 0	37 0 0	15 10 0	33 4 0	32 0 0	16 12 0	15 10 0	30 0 0	7 8 0	21 8 0	10 0 0
9 Punpuli	..	..	..	..	..	..	..	..	..	..	..	..	..	..	55 0 0	52 0 0
10 Kuttalam	6 0 0	25 0 0	26 6 0	13 12 0	7 8 0	45 8 0	45 4 0	42 0 0	38 10 0	44 2 0	61 0 0	43 0 0	21 0 0	31 0 0	23 8 0	31 0 0
11 Sivaisalem	..	..	..	..	..	8 15 0	40 2 0	26 1 0	16 10 0	18 2 0	28 4 0	33 0 0	..	..	..	..
12 Ambur	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13 Koriar	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14 Koilteri	18 0 0	61 0 0	66 4 0	40 0 0	16 0 0	29 12 0	41 8 0	30 8 0	20 4 0	22 2 0	20 0 0	50 9 0	28 0 0	55 8 0	51 0 0	40 8 0
15 Padaramalai	15 0 0	48 4 0	53 0 0	52 8 0	71 0 0	62 0 0	100 0 0	65 0 0	33 4 0	30 0 0	67 10 0	34 4 0	25 0 0	28 0 0	25 8 0	..
16 Vadagarai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60 0 0
17 Terkuviravanallur	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18 Kolundamamalai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19 Manpothai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20 Padmaneri	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21 Kalakad	..	..	..	..	33 0 0	30 8 0	53 4 0	45 0 0	17 8 0	26 2 0	34 0 0	35 1 0	35 4 0	38 8 0	44 8 0	61 0 0
22 Malayadipudur	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23 Tirukarangudi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24 Paravarisuriyan	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25 Vallanad	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Serial number and name of felling series.	1919. (18)	1920. (19)	1921. (20)	1922. (21)	1923. (22)	1924. (23)	1925. (24)	1926. (25)	1927. (26)	1928. (27)	1929. (28)	1930. (29)	1931. (30)	1932. (31)	Average. (32)
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1 Pudupatti	17 12 0	15 8 0	28 0 0	30 0 0	16 0 0	36 0 0	40 0 0	25 0 0	24 0 0	..	11 0 0	16 0 0	10 8 0	11 2 0	14 9 0
2 Rengarkoil	14 8 0	28 0 0	25 0 0	39 0 0	43 0 0	37 0 0	44 0 0	35 0 0	28 8 0	15 0 0	15 0 0	9 0 0	5 12 0	8 8 0	16 0 0
3 Valaikulam	16 8 0	26 0 0	24 0 0	40 0 0	57 0 0	55 0 0	42 0 0	62 0 0	33 8 0	21 8 0	32 0 0	40 0 0	30 0 0	22 0 0	23 13 0
4 Ayyanarkoil	34 0 0	37 0 0	61 0 0	110 10 0	89 2 0	49 0 0	50 0 0	127 0 0	51 0 0	45 0 0	27 0 0	33 0 0	65 0 0	40 0 0	46 1 0
5 Vasudevanallur	..	..	..	..	..	36 0 0	76 0 0	60 0 0	45 0 0	32 0 0	44 0 0	40 0 0	41 0 0	31 0 0	45 0 0
6 Karuppasamikoil	51 4 0	92 0 0	81 0 0	51 0 0	59 0 0	36 0 0	76 0 0	60 0 0	45 0 0	30 0 0	44 0 0	40 0 0	41 0 0	31 0 0	39 13 0
7 Puliarigudi	55 8 0	68 0 0	42 0 0	30 0 0	29 0 0	51 0 0	115 0 0	80 0 0	118 0 0	42 4 0	71 0 0	90 0 0	90 0 0	37 0 0	49 2 0
8 Kadayanallur	25 4 0	61 0 0	36 0 0	34 0 0	41 0 0	32 0 0	63 0 0	27 0 0	47 0 0	40 0 0	16 0 0	20 0 0	35 0 0	16 0 0	28 14 0
9 Punpuli	100 0 0	123 8 0	181 0 0	102 0 0	111 0 0	138 0 0	67 5 0	85 0 0	80 0 0	50 0 0	47 0 0	60 0 0	44 0 0	38 0 0	85 6 0
10 Kuttalam	22 0 0	45 0 0	40 0 0	138 0 0	175 0 0	100 0 0	90 0 0	101 0 0	100 0 0	100 0 0	46 0 0	72 0 0	62 0 0	32 0 0	54 4 0
11 Sivaisalem	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24 7 0
12 Ambur	..	..	..	..	..	..	17 0 0	15 0 0	18 0 0	15 1 0	13 12 0	11 0 0	10 8 0	7 4 0	13 7 0
13 Koriar	..	..	..	..	..	..	30 0 0	33 0 0	29 0 0	17 0 0	16 12 0	25 8 0	36 0 0	35 0 0	27 12 0
14 Koilteri	37 8 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	29 0 0	56 0 0	37 0 0	24 0 0	27 8 0	46 0 0	34 0 0	23 0 0	35 0 0
15 Padaramalai	..	52 0 0	103 0 0	136 0 0	61 0 0	43 0 0	75 0 0	37 0 0	54 0 0	22 0 0	39 0 0	79 0 0	23 0 0	16 0 0	51 13 0
16 Vadagarai	61 0 0	90 0 0	120 0 0	75 0 0	45 4 0	44 0 0	36 0 0	79 0 0	47 0 0	67 0 0	70 0 0	80 0 0	61 8 0	31 8 0	64 8 0
17 Terkuviravanallur	..	..	..	..	..	14 0 0	25 0 0	17 0 0	15 0 0	9 0 0	17 0 0	21 0 0	14 0 0	16 0 0	16 7 0
18 Kolundamamalai	..	..	..	..	..	7 4 0	12 0 0	11 0 0	20 0 0	13 8 0	20 0 0	20 0 0	20 0 0	13 8 0	15 4 0
19 Manpothai	..	..	..	13 4 0	11 0 0	8 8 0	16 0 0	16 0 0	21 0 0	8 8 0	10 8 0	23 0 0	25 0 0	18 8 0	15 10 0
20 Padmaneri	..	..	..	..	..	10 0 0	28 0 0	15 0 0	25 0 0	35 4 0	33 0 0	23 0 0	20 0 0	20 0 0	22 4 0
21 Kalakad	36 0 0	54 0 0	91 0 0	80 0 0	55 0 0	31 0 0	81 0 0	32 0 0	41 0 0	60 0 0	50 0 0	105 0 p	111 0 0	45 0 0	51 0 0
22 Malayadipudur	..	..	..	..	..	20 0 0	12 8 0	14 0 0	14 0 0	61 0 0	22 0 0	22 0 0	9 8 0	9 8 0	20 8 0
23 Tirukarangudi	75 0 0	70 0 0	72 0 0	90 0 0	97 0 0	78 0 0	41 0 0	40 0 0	41 8 0	80 0 0	47 0 0	50 0 0	34 0 0	27 8 0	60 3 0
24 Paravarisuriyan	..	..	..	..	..	..	47 0 0	46 0 0	23 0 0	28 0 0	38 0 0	24 0 0	39 0 0	23 4 0	33 8 0
25 Vallanad	..	..	..	..	..	14 0 0	25 0 0	17 0 0	15 0 0	9 0 0	17 0 0	21 0 0	14 0 0	16 0 0	16 5 0

APPENDIX V.

Mr. Thornton's report of 1893 on afforestation in Kudiramozhi Teri Reserves.

Number.	Date of entry.	Areas and additions from time to time.	Blocks and compartments referred to.	Cost. RS.	A.	P.	Orders, observations and record.
1	1876	13·49 acres of palmyras.	Kudiramozhi Teri (Nazareth) compartment No. 16.	30 38	9 2	4 8	15,000 nuts were planted. Manured with ashes and cow-dung in 1883. Growth very slow. Greatest height, 3 feet. Many dead. Surviving on 6th June 1893.
2	1878	7·87 acres of palmyras.	Kudiramozhi Teri (Nazareth) compartment No. 17.	30	9	4	16,000 nuts were planted. Growth very slow. Greatest height, 3 feet. Many dead.
3	1879	129·80 acres of palmyras.	Nazareth Kudiramozhi compartment No. 18.	97 13 24	10 4 0	10 6 0	50,000 nuts were planted. Manured with ashes and cow-dung in 1884. Cost of two coolies employed for watering the above areas from December to February. Growth better. Three feet to 10 feet. Surviving.
4	1880	125·02 acres of palmyras.	Nazareth Kudiramozhi compartment No. 25.	120	10	4	63,000 nuts were planted. Growth better. Three feet to 10 feet.
5	1881	155·25 acres of palmyras.	Nazareth Kudiramozhi compartment No. 32.	108	1	8	53,000 nuts were planted. Growth better. Three feet to 10 feet.
6	November 1884 ..	96·15 acres of palmyras.	Nazareth Kudiramozhi compartment No. 39.	221	4	5	105,425 nuts were planted. Growth little better. Three feet to 10 feet.
..	Do. ..	....	Nalumavadi	..			394 casuarina seeds planted at 6 feet apart. Improvement fellings done in 1892. 54 trees cut; weight 2½ tons.
6 (*a*)	6th November 1884 ..	37·91 acres of odei ..	Nalumavadi compartment No. 33.	91	4	8	154 measures of odei seeds were dibbled. Growth is little thick and girth is 1 to 2 feet.
6 (*b*)	Do. ..	3·00 acres of nanal.	Do.	6	6	0	Transplanted.
7	November 1885 ..	39·73 acres of palmyras.	Nalumavadi compartment No. 35.	133	7	0	7,500 were planted. Growth little better. Three feet to 5 feet.
7 (*a*)	October 1885 ..	5·47 acres of odei ..	Nalumavadi compartment No. 34.	10	2	0	By penning goats and sheep after feeding them on odei pods and then ploughing the locality.
7 (*b*)	November 1885 ..	4·00 do. ..	Do.	4	1	4	Sown twenty measures of seeds. Growth is little thick but all are mere seedlings of less than 1 foot.
8	November 1886 ..	40·00 acres of palmyras.	Nalumavadi compartment No. 38.				32,400 nuts were planted. Growth very slow. One to 3 feet.
8 (*a*)	Do. ..	33·11 acres of palmyras.	Nazareth compartment No. 15.	148	11	2	18,000 nuts were planted. Growth very slow. One to 3 feet.
8 (*b*)	Do. ..	30·94 acres of palmyras.	Nalumavadi compartments Nos. 4 and 8.				24,600 nuts were planted. Growth little better. One to 6 feet.
8 (*c*)	October 1886 ..	8·00 acres of odei ..	Kudiramozhi	49	2	0	By penning 25 herds of goats and sheep after feeding them on 26 cottahs of odei pods and ploughing the locality.
8 (*d*)	Do. ..	6·50 do. ..	Nalumavadi compartment No. 5.	41	4	0	By penning 20 herds of goats and sheep after feeding them on 20 cottahs of odei pods. Very few have grown. Girth within 1 foot.
8 (*e*)	Do. ..	15·11 do. ..	Kudiramozhi compartment No. 37.	8	10	0	By dibbling the dung discharged by goats after feeding them on 1 cottah of odei pods, mixed with 12 measures of odei seeds. Very few have germinated. Girth within 1 foot.
9	November 1887 ..	199·08 acres of palmyras.	Kudiramozhi compartment No. 31.	248	1	10	10,200 nuts were planted. Growth very slow. Greatest height, 3 feet.
9 (*a*)	September 1887 ..	43·70 acres of odei ..	Kudiramozhi compartment No. 30.	74	11	6	By penning 40 herds of goat and sheep after feeding them on 40 cottahs of odei pods.
9 (*b*)	October 1887 ..	50·00 do. ..		23	13	0	Dibbling 75 measures of odei seeds mixed with cow-dung and sheep-dung. Very few have germinated here and there (scattered). Girth within 1 foot. Height 1 to 4 feet.
9 (*c*)	Do. ..	70·00 do. ..	Kudiramozhi	62	2	0	Dibbling the dung discharged by goat and sheep after feeding them on 30 cottahs of odei pods.
10	November 1888 ..	132·75 acres of palmyras.	Kudiramozhi compartment No. 29.	237	11	8	120,000 nuts were planted. Growth very slow. Greatest height, 3 feet.
10 (*a*)	October 1888 ..	Odei	Do.	132	8	0	By penning 40 flocks of goats and sheep after feeding them on 60 cottahs of odei pods.
..	....	5·00 acres	Do.	7	8	0	For ploughing 5 acres.
10 (*b*)	October 1888 ..	....	Do.	3	4	6	Sowing 35,000 cashewnuts at broadcast.
10 (*c*)	Do. ..	....	Do.	2	0	0	Sowing 15 Madras measures of kolingi shrubs at broadcast.
10 (*d*)	November 1888 ..	30 acres of nanal	Do.	35	5	2	Planting nanal grass in bare places.
10 (*e*)	December 1888 ..	9 acres of odei ..	Do.	7	10	10	Dibbling nine markals of dung discharged by goats.
10 (*f*)	Do. ..	....	Do.	8	0	2	Planting esalai sticks.
11	November 1889 ..	226·70 acres of palmyras.	Kudiramozhi compartment No. 27.	194	1	0	98,280 nuts were planted. Growth very slow. Greatest height, 3 feet.
11 (*a*)	October 1889 ..	19·15 acres of odei ..	Kudiramozhi compartment No. 40.	105	14	9	By penning 27 flocks of goats and sheep after feeding them on 65 cottahs of odei pods. Only five seedlings were found growing in this place. Girth within 1 foot. Height, 1 to 4 feet.
11 (*b*)	Do. ..	36·50 acres of nanal.	Do.	59	12	2	Nanal grass were transplanted in bare places.
11 (*c*)	November 1889 ..	....	Do.	1	0	0	Planted 120 banyan sticks.
11 (*d*)	Do. ..	....	Do.	3	0	0	Planted 2,000 odei and viruvottai seedlings.
11 (*e*)	Do. ..	....	Do.	8	8	0	Dibbling 9,070 cashewnuts in different places.
11 (*f*)	Do. ..	....	Do.	..			300 bamboos and 500 vagai seedlings were transplanted at no cost, of which about 50 bamboos and 100 vagai survived. None surviving now.
11 (*g*)	Do. ..	3·68 acres	Kudiramozhi compartment No. 23.	..			25 mango, 9 vagai and 2 iluppai were transplanted, of which all survive. Height, mango, 5 to 7 feet, vagai 12 to 15 feet, and iluppai, 5 to 7 feet.
12	November 1890 ..	72·15 acres of palmyras.	Kudiramozhi compartment No. 28.	92	13	0	35,001 nuts were planted. Most of them have germinated. The growth is very slow.
12 (*a*)	Do. ..	15·00 acres of cereals mixed with odei seeds.	Kudiramozhi compartment Nos. 19, 20 and 21.	151	3	10	Samai, thinai were sown in ploughed area mixed with odei seeds. Nothing germinated except very few cotton seeds which exist now. Odei seeds. All germinated, but died in hot weather.
12 (*b*)	Do. ..	9·00 acres of nanal.	Do.	35	9	8	Transplanted nanal grass in bare places. Very few have germinated and grown. Others died.
12 (*c*)	Do. ..	....	....	8	12	0	Planted 120 bamboos, 440 cashew seedlings and 200 banyan stick, bamboos, cashew. All died. There is very few growth of banyan.
13	November 1891 ..	185·30 acres of palmyras.	Kudiramozhi compartment No. 26.	244	14	2	98,400 nuts were planted. All have germinated.
13 (*a*)	September 1891 ..	40 acres of odei ..	Kachinavilai compartment No. 9.	69	0	0	By penning 1,500 sheep and goats after feeding them on 48 cottahs of odei pods for 28 days. All germinated, but died in hot weather.
..	....	14 acres of nanal ..	....	58	4	6	Nanal grass was transplanted in bare places at 3 feet apart in 1892, of which none germinated.
13 (*b*)	November 1891 ..	15 acres of cereals mixed with odei seeds.	Kudiramozhi compartment No. 22.	35	4	10	Cotton, castor-oil, odei, babul, green pea, etc., were sown in a ploughed area. Most of them germinated, but died afterwards from want of rain.
13 (*c*)	Do. ..	....	Kudiramozhi and Kachinavilai.	..			Two measures of kudukapulli, 5 measures of tamarind mixed with babul viruvottai and verali seeds were sown broadcast.
13 (*d*)	Do. ..	....	Do.	..			Kudukapulli only germinated near the old well, but died afterwards. 1,570 banyan sticks, 34 usil sticks were planted on the rights of way at no cost by watchers, of which 360 banyan and 10 usil survive.
13 (*e*)	Do. ..	....	Do.	..			Nanal grass also was transplanted by watchers in certain places, but they did not germinate on account of scarcity of the rain.

Mr. Thornton's report of 1893 *on afforestation in Kudiramozhi Teri Reserves*—cont.

Number.	Date of entry.	Areas and additions from time to time.	Blocks and compartments referred to.	Cost. RS. A. P.	Orders, observations and record.
			NURSERIES.		
13 (f)	November 1891 ..	3·68 acres	Compartment No. 23 old well Kudiramozhi.	..	Tamarind 12, audina 60, casuarina 200 and nedalingam 21 were planted at no cost by watchers. In July 1893, tamarind 12 survive, height 3 to 5 feet.; audina, 48 survive, height 1 to 5 feet; casuarina 142 survive, height 1 to 8 feet; nedalingam 4 survive, height 1 to 3 feet.
..	Do. ..	0·55 acre	Padugai compartment No. 36.	..	35 tamarind seedlings were planted by watcher, of which 25 survive. Height, 2 to 4 feet.
..	Do. ..	1·22 acres	Karukuvilancoil side compartment No. 41.	..	Margosa 10, audina 40, casuarina 50 and nedalingam 7 were planted. Surviving—Margosa 4, audina 15, casuarina 30 and nedalingam 3. Height—Margosa, 1 to 3 feet; audina 1 to 3 feet; casuarina 1 to 3 feet and nedalingam, 1 to 2 feet.
..	Do. ..	2·05 "	Kanam side compartment No. 1.	..	200 casuarina seedlings were planted, of which 110 surviving. Height, 1 to 11 feet.
..	Do. ..	4·10 "	Nalumavadi	..	100 casuarina seedlings were planted, of which 92 survive. Height, 1 to 6 feet. Date 1. Height, 6 inches.
14	November 1892 ..	201·30 acres of palmyras.	Kanamtheri	253 12 9	(Cost of 10,890 nuts). 10,890 nuts were planted.
				26 6 0	(Conveying charge).
				50 5 0	(Sowing charge).
				330 7 9	One-half of the seeds have germinated, the rest have struck roots, 80 will come up after good rain.
14 (a)	September 1892 ..	40 acres of odei ..	Muttukrishnapuram side.	30 0 0	Cost of 24 cottahs of pods.
				3 12 0	Conveyance charge.
				21 8 0	Penning charge for 30 days.
				30 0 0	Ploughing charge.
				16 2 0	Transplanting nanal within the area.
				101 6 0	By penning 700 sheep and goats after feeding them on 24 cottahs of odei pods, ploughing the area and transplanting nanal grass in all bare places. All germinated, but some died on account of the scarcity of rain. Many remain now and some of them have even attained 1 foot height in growth.
14 (b)	November 1892 ..	11 acres of cereals with odei, etc.	Do. ..	9 5 0	Cost of peas, 7½ Madras measures, castor-oil 5, thina 5, kadukanni 5, gram 5, kudiravali 5, kamampilloo 5, cotton-seeds ½ tolam, kadiravali 1½ tolams, murukkamvattal ¼, vathakai ¼, odei ½ cottah, babul seeds 12 cottahs.
				24 12 0	Ploughing charge.
				24 9 8	Fencing, walling with athalai, kalli, etc., planted on it.
				21 5 10	Removing korundi and shrubs.
				11 0 0	Manuring.
				91 0 6	By manuring (all manure) the area and ploughing the same thrice after removing all shrubs within the area. All germinated, but most of them died on account of scarcity of rain. Peas, gram kamampilloo, vathakai gave little produce which have been sold. Audina seeds sown at broadcast within the garden are in good state.
				4 10 8	Protecting the above from jackal, etc.
				1 11 8	For collecting the produce.
				6 6 4	
..	Do. ..	10 acres of cereals ..	Kanam teri	9 5 0	Cost of collecting the produce.
				20 10 0	Ploughing.
				20 8 0	Fencing, walling.
				16 5 2	Removing korundi, etc., shrubs.
				10 14 4	Manuring.
				77 10 6	By manuring (tank mud) the area and ploughing the same after removing all shrubs within the area. All germinated, but mostly died. Gram only gave little produce, which was sold. Audina seeds sown at broadcast within the garden are in good state.
				3 0 0	Price of 8 measures of gingelly oil seeds.
		2 acres within the above.	Do.	1 0 0	Ploughing charge. The seeds were sown in the same garden when there was rain in March 1893 with a hope that rain will continue and produce can be expected. All germinated, but at present they are in a dying state.
14 (c)	Do. ..	1·50 acres	Do.	4 7 2	Transplanting nanal grass. Most of them have germinated.
		3·00 "	Muttukrishnapuram ..	7 3 6	Do. do.
	Do. ..	Length, 1 mile and 12 yards.	Tanmavadipannaiwall ..	2 8 0	Cost of 1,200 palmyra nuts.
				4 0 0	Cost of 32 bundles of esalai sticks.
				3 12 0	Cost of 30 bundles of athalai.
				18 9 0	Sowing the above with grass, pacha-thamarai, kolinji, etc., transplanting nanal grass. Few palmyras, esalai, athalai and pacha-thamarai have germinated. Nanal grass has not germinated.
..	....	....	Kanam teri	4 14 4	10 Madras measures of cashew seeds sown at broadcast by coolies by digging small holes among low places overgrown with nanal, etc., grass.
..	....	Semmarikulam ..	....	2 1 5	5 Madras measures of cashew seeds sown at broadcast by coolies by digging small holes among low places overgrown with nanal, etc., grass.
..	....	....	Karukkuvilancoil side ..	2 3 0	Do. do. All germinated and were in good state, but now all are beginning to die for want of rain.

Name of seedlings.		Nazareth new well compartment.			Nazareth old well compartment No. 23.			Padukaikarai Semmarikulam compartment No. 36.			Muttukrishnapuram side compartment No. 12.		
English (local).	Botanical.	No.	Height in feet up to 30th June 1893.	Cost.	No	Height in feet up to 30th June 1893.	Cost.	No.	Height in feet up to 30th June 1893.	Cost	No.	Height in feet up to 30th June 1893.	Cost.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Mango	*Mangifera Indica*	193	5	Planting and manuring, Rs. 37–9–6. Watering, Rs. 37–13–0.	..	..	Planting and manuring, Rs. 22–3–6. Watering, Rs. 33–2–0.	31	3	Planting and manuring, Rs. 2–8–4. Watering, Rs. 23–9–6.	54	4	Planting and manuring, Rs. 17–10–4. Watering, Rs. 7–3–6.
Vagai	....	17	12		..	..		4	3		79	4	
Pambulimas	....	3	2		4	1		..	..		..	..	
Margosa	*Azadirachta Indica*	11	5		3	3		5	3		..	..	
Maruthu	....	3	5		..	..		1	1		8	3	
Tamarind	*Tamarindus Indica*	21	3		12	3		..	..		12	3	
Pannivagai	....	5	10		..	..		..	..		..	..	
Pinnai	*Calophyllum inophyllum*	13	2		..	..		..	..		..	..	
Date	*Phœnix sylvestris*	34	2		12	1		7	1		..	..	
Jack	*Artocarpus integrifolia*	4	2		..	..		..	..		27	2	
Audina	....	20	5		..	..		210	2		10	2	
Nelli	*Emblica officinalis*	..	..		5	2		2	2		..	..	
Iluppai	*Bassia longifolia*	..	..		..	..		7	2		..	..	
Bamboos	*Bambusa arundinacca*	..	..		..	..		22	4		3	5	
Athi	*Ficus racemosa*	..	..		..	..		..	..		..	..	
Kungilium	....	..	..		..	..		..	..		..	..	
Nanal grass	....	..	..		..	..		..	..		..	..	

APPENDIX VI.

Method of Introduction of Pennisetum Cenchroides Grass.

The method of introduction recommended is—

(i) Run over the area lightly with a country plough in September–October.

(ii) Harrow the area with a triangular harrow to clear the weeds after ploughing.

(iii) Sow the seed as soon as any showers have fallen in the north-east monsoon. The seed should be trampled in by herding cattle over the area. The quantity of seed required is about 25 lbs. per acre and can be obtained from the Agricultural Demonstrator, Gobichettipalaiyam, Coimbatore district, to whom application should be made in time.

(iv) As soon as the grass has seeded the first time, the area should be harrowed over again.

(v) The costs per acre are estimated at—

	RS.	A.	P.
Ploughing	1	8	0
Harrowing	0	12	0
Sowing	0	3	0
Second harrowing	0	12	0
Cost of seed at Rs. 2–4–0 per 16 lbs.	3	8	0
Transport of seed to site, etc.	1	5	0
Total ...	8	0	0

Subsequent to the first year the seed can be collected departmentally and the cost per acre will not exceed Rs. 4.

APPENDIX VII.

List of maps accompanying the Working Plan, Tinnevelly cum Ramnad division.

Serial number and name of range and reserved forest.	Number of sheets.
Srivilliputtur Range.	
1 Srivilliputtur Reserved Forest	1 to 6
2 Valaikulam and Sappaniparambu	1
Kuttalam Range.	
3 Kuttalam Reserved Forest	1
4 Krishnapuram Reserved Foreet	1
5 Vasudevanallur Reserved Forest	1 and 2
6 Vadagarai Melpidagai	1
7 Kadayanallur Reserved Forest	1
Ambasamudram Range.	
8 Papanasam Reserved Forest	1 to 7
Nanguneri Range.	
9 Kalakad Reserved Forest	1 to 6
10 Therku Viravanallur Reserved Forest	1
11 Kolundumamamalai and Manpothai Reserved Forests	1
12 Vallanad Reserved Forest	1
13 Kudiramozhi Teri Reserved Forest	1 and 2
14 Management map—	
Srivilliputtur Range	1
Kuttalam Range	1
Ambasamudram Range	1
Nanguneri Range	1

APPENDIX VIII.

Enumeration Results.

Vairavakan Shola, Srivilliputtur Range.

Area of shola—99 acres.

Area enumerated—19·6 acres.

Number of exploitable trees per acre —3·3.

Serial number. (1)	Species. (2)	Breast height girth classes. 3′–4′ (3)	4′–5′ (4)	5′–6′ (5)	6′–7′ (6)	7′–8′ (7)	8′–9′ (8)	9′–10′ (9)	10′–11′ (10)	11′–12′ (11)	Over 12′. (12)	Totals. (13)	Number of exploitable trees. (14)
1	*Mesua ferrea*	5	5	8	12	6	5	1	..	..	..	42	24
2	*Mangifera indica*	1	..	1	2	..	..	..	1	1	..	6	4
3	*Bischofia javanica*	..	1	3	3	2	2	2	..	2	..	15	8
4	*Pygeum wightianum*	..	1	1	2	..	..	..	..	..	..	4	2
5	*Cedrela toona*	1	1	..	..	..	..	1	..	..	2	5	3
6	*Elæodendron glaucum*	..	..	2	3	..	..	..	..	..	..	5	3
7	*Eugenia spp.*	..	..	2	..	..	..	..	..	2	..	4	2
8	*Acrocarpus fraxinifolius*	..	1	1	1	2	1	..	2	..	..	8	5
9	*Vitex altissima*	..	2	..	..	..	..	..	..	..	..	2	..
10	*Dysoxylum malabaricum*	1	2	1	..	..	..	..	..	..	..	4	..
11	*Filicium decipiens*	..	..	1	..	..	..	..	..	..	..	1	..
12	*Artocarpus integrifolia*	..	2	4	1	1	1	..	..	..	..	9	2
13	*Palaquium ellipticum*	1	1	5	7	2	1	1	2	..	..	20	13
	Total ..	9	16	29	31	13	10	5	5	5	2	125	66

APPENDIX IX.

Evergreen Timber Working Circle.

Control Book.

Prescriptions of the working plan—Locality to be exploited. Felling series. (1)	Coupe number. (2)	Area in acres. (3)	Nature of felling. (4)	Possibility. (5)	Operations actually carried out. Locality exploited. Year of working. (6)	Felling series. (7)	Coupe number. (8)	Area in acres. (9)	Nature of felling. (10)	Details of yield. Species. (11)	Number of trees felled. (12)	Yield in cubic feet. (13)	Percentage of total yield. (14)	Total number of trees marked. (15)	Price per marked tree. (16)	Remarks. (17)
															RS. A. P.	
Ambasamudram.	I	206	Selection.	500 trees.	1934	Ambasamudram.	I	206	Selection.	*Mesua ferrea.*	50	3,000	18	75	11 4 0	25 marked trees were unsound.
										Hardwickia pinnata.	70	4,800	29	80	11 4 0	10 marked trees were unsound.

APPENDIX X.

Evergreen Timber Working Circle (similarly for Clear Felling Working Circle).

Record of Works.

Prescriptions of the working plan.				Operations actually carried out.						
Felling series.	Coupe number.	Area in acres.	Nature of work.	Year of working.	Felling series.	Coupe number.	Area in acres.	Nature of work.	Costs.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									RS.	
				A. Measures prescribed.						
Ambasamudram.	I	220	Demarcation and marketing of a maximum of 3 trees per acre including climber cutting.	1934 ..	Ambasamudram.	I	220	Demarcation of coupe and marking of 401 trees including climber cutting.	50	
			Staking and dibbling of seeds in all gaps over 100 square yards in extent including weeding and replacement of casualties.	1934 ..	Do.	I	220	Staking and dibbling of seeds in 150 gaps including weeding and replacement of casualties.	75	Only 150 gaps were handed over for regeneration by contractor; of these 50 gaps were regenerated in June and 100 in October 1934.
				B. Measures suggested.						
				C. Measures neither prescribed nor suggested but carried out.						

APPENDIX XI.

Control Journal for the Evergreen Timber Working Circle and similarly for the Clear Felling Working Circle.

A. Growing stock.

1. Notes on—
   (*a*) the relative timber value of the various species extracted;
   (*b*) the distribution of various species in the annual coupe.

B. Factors influencing the crop.

1. Notes on various forms of damage classified under the following heads with remedies tried or suggested—
   (*a*) climatic,
   (*b*) animals,
   (*c*) insects (with entomological names wherever possible),
   (*d*) fungus (shoud be identified with the help of the Forest Research Institute, if possible),
   (*e*) fire, and
   (*f*) man.

C. Exploitation.

1. Notes on the suitability of the present division into felling series.
2. Notes on the adequacy of the output.
3. Notes on the suitability of the method of working prescribed.
4. Notes on contractors and labour supply.
5. Statement by girth classes and by species of the estimated yield and the net yield of timber obtained from each felling series, with comments on the varying losses in conversion.
6. Statement of prices realized for each coupe and comments thereon.
7. Statement showing cost of exploitation under—
   (*a*) felling charges per tree,
   (*b*) conversion charges per unit,
   (*c*) man handling cost per unit with average distance, and
   (*d*) cost of transport per unit from road head to nearest market with distance in miles.
8. Statement showing the total number of gaps in which charcoal burning was permitted and the total yield of charcoal obtained in tons.
9. Deviations if any from working plan prescriptions with detailed justification.

D. Measures of improvement.

1. Results of tending operations prescribed with costs.
2. Suggestions for improvement of communications and export routes.

E. Regeneration.

1. *Natural regeneration.*—Observations on the extent of natural regeneration of the more valuable species.

2. *Artificial regeneration.*—Detailed comments on the success or failure, with reasons, of
   (*a*) the gap system, and
   (*b*) the clear-felling and planting system with suggestions for improvement or modification of technique.

3. Statement showing
   (*a*) total number of gaps,
   (*b*) the number attempted to be regenerated artificially, and
   (*c*) the number of gaps successfully regenerated.

4. Notes on the relative success obtained with various species by
   (*a*) dibbling or broadcast sowing of seed,
   (*b*) transplanting of seedlings, and
   (*c*) stump planting with costs per unit area or gap.

5. Notes on the effect of charcoal burning on artificial regeneration in the gaps caused by felling.

6. Observations on the relative success obtained with particular species or mixture of species—
   (*a*) under varying light conditions, and
   (*b*) at varying elevations.

7. *Nursery practice.*—Observations on—
   (*a*) the relative merits of shola and open nurseries with costs,
   (*b*) the flowering and seeding of the more valuable timber species in various localities in the division, and
   (*c*) the germinative capacity and plant per cent of seed of various species obtained from different localities.

8. Notes on pre-treatment of seed.

F. Markets.

1. Statement of the prevailing market price per cubic foot for each of the more important evergreen timbers.

2. Statement by species showing the number of trees marked, the number converted the net yield and the gross revenue obtained.

3. Comments on the state of the evergreen timber market in general and on fluctuations in prices with probable reasons.

G. Statistical.

1. Observations on the rate of growth of various species based on sample plot measurements.

2. Statement showing the percentage of unsound trees of each species found in each 1 foot girth class.

H. Summary of Revenue and Expenditure.

A summary of annual revenue and expenditure in such a form as will facilitate comparison with the financial forecast in the working plan—vide Madras Forest Department and Account Code Section 50 (3).

APPENDIX XII.

EVERGREEN TIMBER WORKING CIRCLE.

Regeneration Ledger.

Number of coupe and year of regeneration ..	1934–36.	Espacement adopted	6′ × 6′.
Area of coupe	220 acres.	Total number of stakes	2,250.
Total number of gaps	401	Average number of stakes per gap	15.
Total number regenerated	150	Species introduced.—*Hopea parviflora, Balanocarpus utilis, Hardwickia pinnata.*	
Cost of regeneration	Rs. 75	Rate of daily wages	6 annas per man.
Average cost per gap	Re. 0–8–0		

C. COSTS.

Year and month.	Cost of seed.	Staking.	Dibbling.	Transplanting.	Nursery.	Replacement of casualties.	Weeding.	Total costs.	Monthly rainfall in inches.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

B. DETAILS OF EACH GAP REGENERATED.

Serial number of gap.	Species or mixture.	Number of each species.	Percentage survivals after			Whether charcoal burning was permitted.	Remarks.
			First hot weather.	Second hot weather.	Third hot weather.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

APPENDIX XIII.

Control Book for the Timber cum *Fuel and the Fuel Working Circles.*

Range—Ambasamudram.

Prescriptions of working plan.						Operations carried out.						Details of yield.			
Year.	Name of felling series.	Coupe number.	Area in acres.	System of felling.	Estimated yield in ton per acre.	Year.	Name of felling series.	Coupe number.	Surveyed area of coupe.	Area of coupe actually worked.	Total outturn of coupe.	Description of outturn.	Average outturn per acre.	Revenue realized per acre.	Gross revenue realized.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1934-35.															

NOTE.—Arrear unfelled areas should be brought forward in red ink as balance available or felling—vide section 50 (*c*) of the Forest Code.

APPENDIX XIV.

Record of Works—Timber cum *Fuel and Fuel Working Circle.*

Range :—Ambasamudram.

Name of felling series :

Prescriptions of working plan.				Record of operations carried out.				
Year.	Coupe number.	Area in acres.	Name of work.	Year.	Coupe number.	Work done.	Cost.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
							RS. A. P.	
			A. MEASURES PRESCRIBED.					
1934–35 ..	I	..	1 Demarcation of coupe by cut lines.	1934–35 ..	I	1 Demarcation of coupe by cut lines.	8 0 0	
			2 Demarcation of coupe with cut stone slabs.			2 Demarcation of coupe by cut stone slabs.	10 0 0	
			3 Demarcation of regeneration areas.			3 Demarcation of regeneration areas.	4 0 0	
			4 Artificial regeneration of burnt strips.			4 Artificial regeneration of burnt strips.	52 0 0	
			B. MEASURES SUGGESTED.					
			C. MEASURES CARRIED OUT BUT NOT PRESCRIBED OR SUGGESTED.					
						1 Climber cutting	25 0 0	
						2 Thinning of coppice shoots (experimental 5 acres).	5 0 0	

APPENDIX XV.

CONTROL JOURNAL FOR THE TIMBER *cum* FUEL AND FUEL WORKING CIRCLES.

A. Growing stock.

1. Notes on the relative fuel or small timber value of various species, and their distribution in the several felling series.

2. Notes on the suitability of the rotation and the silvicultural system prescribed.

B. Factors influencing the crop.

1. Notes on various forms of damage to the crop under the following heads:—

(*a*) climatic,
(*b*) animal,
(*c*) insect,
(*d*) fungus, and
(*e*) weeds and climbers.

2. Notes on forest offences and suggestions for preventing or moderating them under following heads:—

(*a*) Illicit fellings or removals of forest produce,
(*b*) Illicit grazing,
(*c*) Illicit hunting and fishing,
(*d*) Trespass into the reserves or assault of forest subordinates,
(*e*) Offences under the Sandalwood and Timber Transit Rules.
(*f*) Miscellaneous offences.

3. Incidence of fires and comments on the necessity for or adequacy of the protection measures prescribed.

C. Exploitation.

1. Notes on the suitability of the present division into felling series with reference to the requirements of local markets and the convenience of contractors.

2. Notes on the various methods of exploitation adopted by contractors with costs per unit, i.e., a ton of 128 stacked cubic feet of fuel or 50 cubic feet of timber.

3. Notes on the reliability and work of individual contractors, and on the labour supply.

4. Statement of outturn realised from the several felling series and comparison with that obtained from indicator areas where any have been cut.

5. Statement of prices realised per acre in each felling series and comments.

6. Reasons why any particular series was not worked in any year.

D. Regeneration.

1. *Natural regeneration.*—Detailed observations (preferably sample plot measurements) on—

(*a*) the regrowth of coppice shoots,
(*b*) the causes of failure of coppice,
(*c*) the relative coppicing powers of various species,
(*d*) the influence of season of cutting and methods of coppicing on regrowth, and
(*e*) the extent of seedling regeneration of important timber and fuel species.

2. *Artificial regeneration.*—Notes on—

(*a*) the success or failure of rab regeneration measures prescribed with probable reasons,
(*b*) the relative success attained with various species attempted to be introduced, especially exotics, and
(*c*) suggestions for improvement or modification of the technique of rab regeneration.

3. *Nursery practice.*—Notes on—

(*a*) the germinative capacity and plant per cent of seeds of various species,
(*b*) the pre-treatment of seed with results, and
(*c*) the time of flowering seeding and leaf fall of the more important species.

E. Markets.

1. *Demand and supply.*—Notes on the adequacy of the supply of fuel and small timber to the various markets and the suitability of the present division into felling series with reference to local market requirements.

2. Prices of fuel, charcoal and small timber in important markets.

F. Statistical.

Statistics.—Note on the rate of growth of fuel and timber species based on periodical measurements of coppice growth of known age and on ring countings.

G. Summary of Revenue and Expenditure.

A summary of annual revenue and expenditure in such a form as will facilitate comparison with the financial forecast in the Working Plan—Vide Madras Forest Department and Account Code—section 50 (3).

APPENDIX XVI.

Rab Regeneration Ledger for the Timber cum *Fuel and Fuel Working Circle.*

Name of Felling Series

Range :

Year of regeneration :

Number of coupe regenerated :

Area regenerated :

Number of rab lines :

Total length of rab lines :

Nature of operations. (1)	Date of operations. (2)	Total cost. (3)	Rate of cooly wage. (4)	Species sown with quantity of seed. (5)	Species planted with number of seedlings. (6)	Results of operations.		Remarks. (9)
						At the beginning of second growing season. Average number of seedlings per chain of line. (7)	At the beginning of third growing season. Average number of seedlings per chain of line. (8)	

APPENDIX XVII.

Clear-felling Working Circle.

Control Book.

Prescriptions of the working plan.				Operations actually carried out.								Remarks. (13)
Locality to be exploited.				Locality exploited.								
Felling series. (1)	Coupe number. (2)	Area in acres. (3)	Nature of felling. (4)	Year of working. (5)	Felling series. (6)	Coupe number. (7)	Area in acres. (8)	Nature of felling. (9)	species. (10)	Yield in c.ft. (11)	Price per acre. (12)	

APPENDIX XVIII.

Regeneration Ledger—Clear-felling Working Circle.

Name of range—Ambasamudram.
Locality—Kariar.
Area—20 acres.
Cost of demarcation—Rs. 15.
Year of plantation—1934–35.
Price of standing crop—Rs. 35 per acre.
Date of completion of clear felling—15th March 1934.
Date of first burning—21st March 1934.
Date of completion of successive burnings—15th April 1934.

Date of sowing or dibbling other species—
Date of planting (teak)—5th May 1934.
Espacement—6′ × 6′.
Total number of stakes—24,200.
Number of Kanis in settlement—10 families.
Rate of daily wages—6 annas.
Name of ranger in charge—Mr. A. Culas.
Percentage of stocking at beginning of second growing season for each species separately.
Percentage of stocking at beginning of third growing season.

Year and month. (1)	Nursery costs. (2)	Collection of seed. (3)	Preparation of stumps and transport. (4)	Lining and staking. (5)	Planting teak stumps including replacements. (6)	Planting or sowing other species including replacements. (7)	First weeding. (8)	Second weeding. (9)	Third weeding. (10)	Weeding in second year. (11)	Second weeding in second year. (12)	Cleaning in third year. (13)	Other expenses. (14)	Monthly total expenditure. (15)	Monthly rainfall nearest R.G. station. (16)	Progressive total of annual expenditure. (17)	Remarks (18)
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.		RS. A. P.	
1934–35.																	
April																	
May																	
June																	
July																	
August																	
September																	
October																	
November																	
December																	
January																	
February																	
March																	

APPENDIX XIX.

Control Book for the Reserve Sandal Working Circle.

Range : Srivilliputtur.
Alagarcoil Felling Series.

Prescriptions of the working plan.				Record of operations carried out.							
Locality to be exploited.				Locality exploited.							
Year.	Number of block.	Area in acres.	Nature of fellings.	Year.	Number of block.	Area in acres.	Nature of fellings.	Sub-coupe number.	Area in acres.	Yield (rough cleaned wood).	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
										T. C. Q. LB.	
1934–35 ..	I	..	Uprootal of dead sandal.	1934–35 ..	I	..	Uprootal of dead sandal.	1	..	2 16 8 6	
								2	..	1 10 19 10	
										4 12 3 16	

APPENDIX XX.

Records of Works (Sandal Working Circle).

Range : Srivilliputtur.

Prescriptions of the working plan.				Record of operation carried out.				
Year.	Locality.	Area in acres or quantity.	Nature of work.	Year.	Locality.	Area in acres or quantity.	Nature of work.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			A. Measures prescribed.					
1934–35.	Compartment I. Alagarcoil Felling Series.	..	1 Tending of growing stock.	1934–35.	Alagarcoil Compartment I.	..	Cutting climbers and freeing sandal from overhead shade.	Total cost Rs. or 1 anna per acre.
Do.	Kadayam beat .. Aladiyur beat. Sengalteri beat.	..	2 Creation of propagation centres ; four in each beat.	Do.	Kadayam beat .. Aladiyur beat. Sengalteri.	4 × 10′ × 10′. 4 × 10′ × 10′ 4 × 10′ × 10′	.. .. ..	
Do.	Compartment I. Alagarcoil Felling Series.	2 acres.	3 Line sowing of sandal.	Do.	Compartment I. Alagarcoil Felling Series.	2·00	20 chains sown.	
Do.	The whole division.	..	Retail sale of sandal to the public.	Do.	Srivilliputtur main depot.	180 billets : 300 lb.	District Forest Office .. 60 Range Office, Srivilliputtur. 30 Range Office, Kuttalam .. 20 Range Office, Ambasamudram .. 40 Range Office, Kalakad .. 30	Retail price Rs. 1,000 per ton.
			B. Measures Suggested.					
1934–35.	Alagarcoil Felling Series.	..	1 Dibbling in bushes.	..	Alagarcoil Felling Series Block I.	3 acres.	Dibbling sandal seeds in the shade of bushes.	Done free by subordinates.
			C. Measures neither prescribed nor suggested but carried out.					

APPENDIX XXI.

(*a*) Control Journal for the Sandal Working Circle.

A. Growing stock.

1. Remarks on—

(*a*) the spread or disappearance of sandal as compared with the stock maps, and
(*b*) the ecology of sandal.

B. Factors influencing the crop.

1. Notes on the new appearance of spike disease.

2. Incidence of fire in sandal areas annually with observations on the effect of fire on sandal.

3. Observations on the influence of climate and elevation on the sandal growing stock.

4. Remarks on the prevalence of sandal theft; and destruction or damage to sandal by man or animals.

5. The incidence of grazing in sandal areas and its effect on the sandal.

6. The effect of conducting coppice fellings in sandal areas on the sandal growing stock.

C. Exploitation.

1. Remarks on the suitability or adequacy of exploitation prescribed.

2. Abstract of the number of trees marked in each block in girth classes and proportion of sapwood trees.

3. Abstract of cost of exploitation for each item of work with explanation for annual variations.

4. General remarks on the results of inspection of main depot.

5. Remarks on labour supply.

6. Detailed reasons with authority for deviation from working plan prescriptions.

D. Measures of improvement.

1. Remarks on the conduct of tending operations prescribed; their costs and results.

2. Results of fire-protection operations with costs.

3. Suggestions for improvement of communications.

E. Regeneration.

1. *Natural regeneration.*—Observations on the extent of natural regeneration in various compartments and probable causes of its poverty or abundance in any particular locality.

2. *Artificial regeneration.*—Observations on the success or failure of propagation centres, strip regeneration experiments prescribed. Results of methods of regeneration not prescribed but carried out, with costs.

3. *Nursery practice.*—Observations on—

(*a*) the time of flowering and seeding of sandal; whether the species seeds twice a year always; comparison of the first and second seed crops,

(*b*) the relative germinative capacity and plant per cent of seeds from different localities in the division, and

(*c*) the effect of various methods of pre-treatment of seed.

F. Markets.

1. *Sandal prices.*—Statement of the quantity of each class of sandal marketed with corresponding prices obtained; statement of gross and nett revenue realized.

2. *Retail sale.*—Statement of total quantity of sandal sold annually at each retail sale depot with comments on the system of sale, mode of advertisement, etc.

G. Statistical.

1. Observations of the rate of growth of sandal based on measurements of trees of known age, or periodical measurements of the same trees, or from ring countings.

2. Statement of dryage, loss in conversion, etc.

3. Outturn averages.

H. Summary of Revenue and Expenditure.

A summary of annual revenue and expenditure in such a form as will facilitate comparison with the financial forecast in the Working Plan—Vide Madras Forest Department and Account Code—section 50 (3).

(b) Propagation Centre Journal.

Range—Ambasamudram.

Year.	Name of beat.	Locality.	Propagation centre.		How formed.	Origin of seed.	Name of host species.	Date of sowing		Date of first germination of sandal.	Date of completion of germination of sandal.	Replacement of casualties.		Survivals at the beginning of May 1935.	Survivals at the beginning of May 1936.	Remarks.
			Serial number.	Size.				Sandal	Host.			Date.	Number of seedlings.			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)		(10)	(11)	(12)	(13)	(14)	(15)	(16)
1934–35.	Aladiyur.	Right bank of the Tambraparni.	1	10′ × 10′.	Clearing under growth piling and burning slash wounding soil. Dibbling of sandal 3′ × 3′ and fencing with bamboo fence 6′ high.	Mundanthorai plateau.	*Dodonea viscosa. Bambusa arundinacea.*	21st April 1934.	21st April 1934.	24th May 1934.	25th June 1934.	20th October 1934.	5	15	10	A sketch showing the locality is affixed. Watering was done for the first two weeks after sowing.

(c) Strip Regeneration Leder.

Range : Srivilliputtur.

Number of registration area : 1.

Number of strips . . . . . 20.

Average length and width of strips.

Locality : Compartment I Alagarcoil Felling Series (map attached).

Operations carried out.									Results obtained.					
Year.	Nature of operations.	Date.	Rate of coolie wage.	Cost.	Origin of seed.	Date of first germination.	Date of completion of germination.	Number of casualties replaced.	At the beginning of second monsoon.			At the beginning of third monsoon.		
									Date of enumeration.	Number of sandal seedlings.	Average height of seedlings.	Date of enumeration.	Number of sandal seedlings.	Average height of seedlings.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1934–35	1. Demarcation of area. 2. Cutting strips .. 3. Piling slash .. 4. Burning slash .. 5. Collection of stakes. 6. Soil preparation and staking. 7. Sowing sandal and hosts. 8. Fencing .. 9. Replacement of casualties. 10. Tending (if any).			RS. A.										

APPENDIX XXII.

THE GRAZING WORKING CIRCLE.

Control Book.

Prescriptions of the working plan.					Operations carried out.									
Year	Range and area.	Localities closed to grazing.	Area in acres.	Penning.	Range and area.	Localities closed to grazing.	Area. in acres.	Number and description of cattle grazed.	Revenue realised.	Name of pen.	Number of cattle licensed to pen.	Revenue realised.	Grazing incidence per cow unit.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
			ACS.				ACS.		RS.			RS.	ACRES.	
1934-35 (1st July 1934 to 30th June 1935).	Kuttalam 51,888 acres.	Permanent closure— (1) Area above the grazing working circle boundary.	18,042	To be closed anywhere within the grazing working circle but outside the fuel and timber cum fuel working circles on payment.	Kuttalam.	Permanent closure— (1) Area above the grazing working circle boundary.	18,042	3,400 cows and bulls. 1,000 sheep. 50 buffaloes.	1,700 250 50	Virusadikidai	250 cows and bulls.	Free ..	7·25	
		Temporary closure— (1) Timber cum fuel Working Circle— (a) Kuttalam felling series coupes I, VII to XII.	820			Temporary closure— (1) Timber cum Fuel Working Circle— (a) Kuttalam felling series coupes I, VII to XII.	820							
		(b) Puliangudi felling series coupes I, XXI to XXVI.	743			(b) Puliangudi felling series coupes I, XXI to XXVI.	743							
		(2) Fuel Working Circle— (a) Matalamparai felling series coupe I.	109			(2) Fuel Working Circle— (a) Matalamparai felling series coupe I.	109							
		(b) Punpuli felling series (old) coupes XI to XVII.	519			(b) Punpuli felling series (old) coupes XI to XVII.	519							
		(c) Chinnakadu felling series coupe I.	43			(c) Chinnakadu felling series coupe I.	43							
		(d) Kadayanallur felling series coupes I, VI to XIV.	708			(d) Kadayanallur felling series coupes I, VI to XIV.	708							
		(e) Karuppasamikoil felling series coupes I, III to XI.	663			(e) Karuppasamikoil felling series coupes I, III to XI.	663							
		(f) Vasudevanallur felling series coupes I, V to X.	915			(f) Vasudevanallur felling series coupes I, V to X.	915							
		(3) All fire burnt areas exceeding 500 acres in extent	..			(3) Kuttalam East Mattalamaparai Chinnakadu Palayar.	5,315							
						Total ..	22,877							

APPENDIX XXIII.

Grazing Working Circle.

Control Journal (Sample headings).

1. Annual abstract of grazing permits issued by villages. The following headings are suggested:—

(*a*) Year.
(*b*) Name of range.
(*c*) Name of village.
(*d*) Number and description of permits issued.
(*e*) Number and description of permits issued in previous year.
(*f*) Reasons for increase or decrease.

2. Notes on the suitability or otherwise of the agency of collection employed.

3. Notes on the suitability or otherwise of the grazing year adopted.

4. Notes on the efficacy of closure of burnt areas (*a*) as a preventive measure, (*b*) as a silvicultural measure.

5. Notes on the efficacy of enhancement of grazing fees in burnt areas (*a*) as a preventive measure, (*b*) as a silvicultural measure.

6. List of areas closed to grazing annually on account of fires with notes on the results of half-yearly inspections.

7. Notes on the desirability or otherwise of closure of fuel coupes to grazing.

8. Notes on the necessity for extending or reducing the limits of the grazing working circle in each range.

9. Notes on semi-wild cattle in Vallanad and Kudiraimozhi Teri Reserves in Nanguneri Range with details of methods adopted or suggested to deal with these pests.

10. Notes on the incidence and intensity of cattle diseases in the division.

11. Notes on the bison sanctuaries in Nanguneri Range.

12. Notes on the desirability or otherwise of permitting penning.

13. Statement of revenue and expenditure (if any) as laid down in section 50 (*c*) of the Madras Forest Code.

APPENDIX XXIV.

Control book for Minor Forest Produce Working Circle.

Range :

Prescription of working plan.					Record of operations carried out.						
Year.	Name of produce.	Method of working.	Unit of lease.	Period of lease.	Method of working.	Unit of lease.	Period of lease.	Yield obtained.	Gross revenue realized.	Expenditure incurred.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

APPENDIX XXV.

Record of Works—Minor Forest Produce Working Circle.

Range—Ambasamudram.

	Prescriptions of working plan.		Operations carried out.			
Year.	Locality.	Nature of work.	Locality.	Nature of work.	Cost.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1934–35 ..	All main roads and paths.	Planting *Terminalia chebula* and Tamarind as avenue trees.	Papanasam Kariar road 1 mile to 1½ miles.	Planting 132 tamarind seedlings.	..	50 survivals on 31st April 1936.

APPENDIX XXVI.

AFFORESTATION WORKING CIRCLE.

Record of Works.

	Prescriptions of the working plan.			Record of operations carried out.					
Year.	Locality.	Area or quantity.	Nature of work.	Year.	Locality.	Area or quantity.	Nature of work.	Cost of each operation.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					A. MEASURES PRESCRIBED.			RS. A. P.	
1934–35 ..	Nazareth block compartment 5.	Up to 5 acres.	Fuel plantations with line sowings of *Dodonea viscosa* and prickly-pear.	1934–35 ..	Nazareth block compartment 5.	2 acres.	Fuel plantations with alternate line sowings of *Dodonea viscosa* and prickly-pear.	20 0 0	Only 2 acres were attempted as an experimental measure. *Albizzia lebbek* 75 per cent success *Azadirachta indica* 50 per cent success *Acacia planiferons* 75 percent success, *Dalbergia multiflora* 25 per cent success. } March 1935.
1934–35 ..	Kachinavilai block ..	5 acres ..	Cashew planting at an espacement of 24′ × 24′.	1934–35 ..	Kachinavilai block ..	5 acres ..	Cashew planting at an espacement of 24′ × 24′.	62 8 0	Dibbling was resorted to as there was not sufficient time to raise nursery seedlings or stump plants. Per cent success on March 1935, 50 per cent.
1934–35 ..	Teri East block ..	100 acres.	Palmyra dibbling at an espacement of 10′ × 10′.	1934–35 ..	Teri East block ..	100 acres.	Palmyra dibbling at an espacement of 10′ × 10′.	125 0 0	Per cent success on March 1935, 85 per cent.

B.—MEASURES SUGGESTED.

C.—MEASURES NEITHER PRESCRIBED NOR SUGGESTED BUT CARRIED OUT.

APPENDIX XXVII.

Afforestation Working Circle—Control Journal (Sample headings).

A. Growing stock.

1. Notes on the relative fuel and small timber value of various species and their distribution in the several blocks.

2. Notes on the relative sand fixation value of various shrubs, grasses and tree species found on the Teri.

B. Factors influencing the crop.

1. Notes on various forms of damage to the crop under the following sub-heads:—
   (*a*) Climatic.
   (*b*) Animal.
   (*c*) Insect.
   (*d*) Fungus.
   (*e*) Weeds and climbers.

2. Notes on forest offences and suggestions for preventing or moderating them under the following sub-heads:—
   (*a*) Illicit felling or removals of forest produce.
   (*b*) Illicit grazing.
   (*c*) Trespass or assault of forest subordinates.
   (*d*) Miscellaneous offences.

3. *Artificial regeneration.*—Notes on—
   (*a*) the success or failure with probable reasons of
      (i) the fuel plantations,
      (ii) the cashew plantations, and
      (iii) the palmyra plantations.
   (*b*) the relative success obtained with various species attempted to be introduced with relative costs, and
   (*c*) the technique of introduction of various species with suggestions for its improvement or modification with reasons.

4. *Nursery practice.*—Notes on—
   (*a*) the germinative capacity and plant per cent of seeds of various species with reference to the locality of collection, age of seed-bearers, etc., and
   (*b*) the pre-treatment of seed with results.

C. Exploitation.

1. Remarks on the suitability or adequacy of the exploitation prescribed.
2. Abstracts of enumerations of palmyras in each farm.

D. Measures of improvement.

Suggestions for improvement of communications.

E. Regeneration.

Natural regeneration.—Observations on the extent of natural regeneration in various blocks or compartments and the probable cause of the poverty or abundance in any particular locality.

F. Markets.

1. Retail and wholesale prices of forest produce such as cashew nuts, screwpine flowers, palmyra leaves and fibre, etc.
2. Principal centres of consumption of such produce.

G. Statistical.

Observations on the rate of growth of palmyras and tree species based on periodical measurements of trees of known age or of the same trees.

H. Summary of Revenue and Expenditure.

A summary of annual revenue and expenditure in such a form as will facilitate comparison with the financial forecast in the Working Plan—Vide Madras Forest Department and Account Code—Section 50 (3).

APPENDIX XXVIII.

Afforestation Working Circle.

Plantation Ledger (Fuel Plantation).

Year : 1934–35.
Locality : Nazareth Block.
Area : 2 acres.

Year and month.	Demarcation.	Nursery costs.	Staking and aligning.	Manuring.	Seed collection.	*Dodonea* line sowing.	Prickly pear line sowing.	Fuel species.			Replacement of casualties.	Other Expenses.	Monthly rain-fall in inches Nazareth.	Progressive totals.	Remarks.
								Sowing.	Dibbling.	Planting.					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1934–35.															
April															
May															
June															
July															
August															
September															
October															
November															
December															
January															
February															
March															

APPENDIX XXIX.

Afforestation Worring Circle.

Plantation Ledger (Cashew Planting).

Year : 1934–35.
Locality : Kachinavilai Block.
Area : 5 acres.

Year and month.	Demarcation.	Nursery costs.	Seed collection.	Staking and aligning.	Dibbling.	Planting.	Replacement of casualties.	Manuring.	Watering.	Other expenses.	Progressive total of expenditure.	Monthly rain-fall in inches Nazareth.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1934–35.													
April													
May													
June													
July													
August													
September													
October													
November													
December													
January													
February													
March													

APPENDIX XXX.

MISCELLANEOUS PRESCRIPTIONS.

(a) *Control Book* (*Bamboo exploitation*).

Prescriptions of the working plan. Locality to be exploited.				Operations actually carried out. Locality exploited.				Details of yield.		Remarks.
Year.	Range.	Locality.	Nature of fellings.	Year.	Range.	Locality.	Nature of fellings.	Yield.	Price obtained.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									RS.	
1934–35.	Kuttalam.	Kuttalam reserve—Vallam beat.	All one year culms and at least 8 older culms to be reserved in each clump.	1934–35.	Kuttalam.	Kuttalam reserve—Vallam beat.	All one year culms and at least 8 older culms in each clump reserved.	33,000	3,300	The high price obtained was due to keen competition. The coupe was sold to contractor Arumugham Pillai of Shencottah.

(b) *Record of Works* (*Bamboo regeneration*).

Prescriptions of the working plan.				Operations actually carried out.					Remarks.
Year.	Range.	Locality.	Nature of work.	Year.	Range.	Locality.	Nature of work.	Costs.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
								RS.	
				A. MEASURES PRESCRIBED.					
1934–35.	Ambasamudram.	Aladiyur plateau.	Planting of 5 acres with rhizome cuttings of *Bambusa arundinacea* at at an espacement of 33′ × 33′.	1934–35.	Ambasamuddram.	Aladiyur plateau.	Five acres were planted up at an espacement of 33′ × 33′ with seedlings of *Bambusa arundinacea* in October 1934 in pits and fenced against browsers.	15	A surveyed sketch of the area is attached. As rhizome cuttings not available seedlings were used.
				B. MEASURES SUGGESTED.					
				C. MEASURES NEITHER PRESCRIBED NOR SUGGESTED BUT CARRIED OUT.					

(c) *Record of Works* (*Valliyur reserve*).

Range—Nanguneri.

Prescriptions of the working plan.			Operations actually carried out.				Remarks.
Year.	Locality.	Nature of work.	Year.	Locality.	Nature of work.	Costs.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
						RS.	
			A. MEASURES PRESCRIBED.				
1934–35.	Valliyur reserve.	*Albizzia lebbek* plantation at an espacement of 12′ × 12′ with cashew introduced at an espacement of 24′ × 24′:—2 acres.	1934–35.	Valliyur reserve.	A mixed plantation of *Albizzia lebbek* and cashew at the prescribed espacement was raised from seed sown in September 1934 over an area of 2 acres.	10	A surveyed sketch of the area is attached. Survivals at the end of March 1935 were 205 *Albizzia lebbek* and 45 cashew seedlings.
			B. MEASURES SUGGESTED.				
			C. MEASURES NEITHER PRESCRIBED NOR SUGGESTED BUT CARRIED OUT.				

APPENDIX XXXI.

BOUNDARIES OF MINOR FOREST PRODUCE FARMS, TINNEVELLY *cum* RAMNAD DIVISION.

Srivilliputtur Range.

Athithonda section—Farm No. I.—North, from R.F. cairn No. 25 near Sundakoi Kanavoi to Kambathu Medu, Kasikathankombu, Muriappanjanmottai, Kuthukalmottai, along stream as far as Periyamaruthodai, Virusadi to Mudaliyaruthu bungalow and on to Chittar and thence to Valaiyar near Rakkividathimottai; east and south, reserve boundary from pillar No. 25 abovesaid as far as Valaiyar near coupe V of Ayyanarkoil working circle; west, from near Rakkividathimottai along Valaiyar to reserve boundary.

Mudangiyar section—Farm No. II.—North, from near Rakkividathimottai to Panjanthangimottai and on to Thirnatherimottai; east, western boundary of Farm No. I; south, reserve boundary from Valaiyar to Settur Zamin boundary as far as Thirnatherimottai.

Pudupatti section—Farm No. III.—East and north, reserve boundary starting from Sundakoi Kanavoi path, reserved forest pillar No. 25 along the boundary as far as Periyar; west, Saptur Zamin and Periyar; south, as far as boundary of Farm Nos. I and II.

Nanguneri Range.

Farm No. I.—Includes Kolundumamalai, Manpothai and Therku Viravanallur reserves as far as the taluk boundary.

Farm No. II.—Starting from cairn No. 1 of Kalakad Reserved Forests, near Kannimarammankovil the boundary runs right up the old fire line along the ridge through points 1853, 2196, 2283, 2622, 2889 and 3278 to Panjanthangimottai; thence along the taluk boundary between Ambasamudram and Nanguneri taluks till it reaches the Kalakad Reserved Forest boundary and thence along this boundary in a southerly direction to the starting point.

Farm No. III.—Starting from cairn No. 1 on Kalakad Reserved Forest boundary, the line runs towards south along this boundary till it reaches Karungalkajam and thence upwards along Karungalkajam till it meets Manpothai enclosure boundary; thence along this boundary till it reaches the water-shed, which separates Manimuttu Ar from Narakadu Ar and thence along this water-shed through points 5238, 5139 to point 5272 in the Travancore frontier line; thence along the Travancore frontier boundary in westerly direction till it meets the Singampatti Zamin boundary and thence along the Singampatti frontier till it reaches Panjanthangimottai and thence in a south-easterly direction along Nanduthumottai through points 3278, 2889, 2622, 2283, 2196 and 1853 to the starting point in the reserved forest boundary.

Farm No. IV.—Starting from Karungalkajam stream where it cuts the Kalakad Reserved Forest line, the boundary runs in a southerly direction along Kalakad Reserved Forest boundary till cairn No. 19 in Tamarai Ar; thence along the ridge upwards in a westerly direction through points 1432, 1933, 2426, 3180 and 4564 on Manimottai to Travancore frontier; thence along this frontier line as far as point 5272 near Vanganaicken anicut; thence it turns towards east along the water-shed through points 5158, 5238 and thence along the same ridge towards north where it touches Manpothai enclosure; thence along the enclosure boundary till it cuts Karungalkajam and thence along this stream right down to the starting point on the Reserved Forest boundary.

Farm No. V.—All the Reserved forests lying south of the line from cairn No. 19 above Tamarai Ar in Kalakad Tirukurangudi forests to Travancore frontier via points 1432, 1933, 2426, 3180 and 4564 on Manimottai.

APPENDIX XXXII.

CORRESPONDENCE AND ORDERS RELATING TO TREATMENT OF SEMI-WILD CATTLE IN SRIHARIKOTA RESERVE, NELLORE DIVISION.

Copy of letter from the Conservator of Forests, III Circle, Madras, to the Chief Conservator of Forests, Madras, dated 26th January 1923, *C. No.* 1514-22.

[*Reference.*—Chief Conservator's No. 2767/22-1, dated 22nd August 1922, regarding grazing scheme—Introduction—Sriharikota Reserve—Nellore district.]

The proposed system has actually been introduced during the current grazing season, i.e., since July last. I enclose a copy of the form of agreement which was framed by the District Forest Officer in consultation with the Public Prosecutor.

The Range Officer made a special census of the cattle of the 11 villages concerned which differs in some cases from the figures of the last revenue census, the differences being in one direction in some cases and in the other in the rest. In the aggregate the difference is small.

All the villages concerned have accepted the new system and are reported to be satisfied with it.

The following statement compares the grazing revenue for the current year with those of the previous three years:—

Source of revenue.	1919–20.	1920–21.	1921–22.	1922–23.
	RS.	RS.	RS.	RS.
Grazing fees	1,106	981	890	1,788
Recovered in grazing offence cases.	380	134	618	..
Total ...	1,486	1,115	1,508	1,788

It will be seen that the revenue is actually higher than even before and is collected in the most satisfactory way, i.e., by direct payment.

The friction caused by impounding and subsequent action against illicit grazing is absent and the subordinates' time is not wasted in often vain efforts to catch trespassing cattle.

I recommend that the system be continued.

ENCLOSURE.

Agreement made this day of between the Right Honourable The Secretary of State for India in Council, His representative the District Forest Officer, Nellore (acting for and on behalf of the Secretary of State) hereinafter called the District Forest Officer, Nellore, of the one part and the village ryots namely

1.

2.

3.

of village taluk (hereinafter called the village ryots) of the other part.

As the ryots of the village have no facility to graze their cattle and as they requested the Government to arrange for their cattle grazing, it has been arranged (by the Government) for the grazing of the villagers' cows, bullocks, she-buffaloes, he-buffaloes and the sheep only in Sriharikota Reserved Forest under the condition hereinafter appearing. Now these presents that for carrying the said agreement into execution the lessees for themselves, their executors, administrators, legal representatives and assignees and the Secretary of State for himself and his successor and assignees do hereby mutually contract with the other and others of them as follows:—

Conditions of the agreement.—Irrespective of the number of cattle the lessees possess they should pay to the Government for the number of cattle as per last cattle census within 1st July of every year at the rates given below:—

(1) Cow or bullock or calf—8 annas per head of cattle.

(2) She-buffalo or he-buffalo or calf—12 annas per head of cattle.

(3) Sheep—4 annas per head.

The Government has the right to recover the amount due from the villages (as per rates noted above) from all the villagers as a body or from each individual (without taking into consideration the number of cattle each ryot may possess).

If the full allotment is not paid up by 1st July, the Government has the right to recover the balance due from the ryots as arrears of land revenue with interest at 6¼ per cent per annum.

Goats should not be allowed to graze in reserved forest at any time.

Any kind of cattle should not be allowed to graze in the coupes attached to the reserve or in any other closed areas.

If any of the ryots goes against the conditions referred to above and if the Government sustains any loss thereby, the village ryots shall be held jointly and severally responsible for the payment of the loss the Government may sustain.

Signed by the abovenamed
in the presence of

District Forest Officer.

Signed by the abovenamed
in the presence of

Village ryots.

Proceedings of the Chief Conservator of Forests, No. 49, Mis., dated 16th February 1924.

[Grazing fees—Sriharikota Reserve—Nellore district—Reduction—Sanctioned.]

READ—the following paper:—

G.O. Mis. No. 269, Development, 12th February 1924.

Read—the following:—

G.O. No. 847, Revenue (Special), dated 7th December 1918.

From the Chief Conservator of Forests, Madras, No. 2767/22-2, dated 22nd February 1923.

Order—Mis. No. 269, Development, dated 12th February 1924.

The Government are pleased to sanction the reduction with effect from 1st July 1922 of the grazing fees in the Sriharikota Reserve in the Nellore district from Re. 1 to 8 annas per cow unit on condition that the villages take out permits for all the cattle in the eleven villages concerned as per the last cattle census.

(By order of the Governor in Council)

F. NOYCE,
Secretary.

Resolution—No. 49, Mis., dated 16th February 1924.

Communicated to the Conservator of Forests, III Circle, with reference to the correspondence ending with his letter C. No. 1514-22, dated 26th January 1923.

(Signed)————,
for *Acting Chief Conservator.*

To the Conservator, Third Circle, Madras.

Paragraphs 63 to 66 of Sriharikota Working Plan.

63. *Grazing.*—Prior to the year 1919–20 grazing was regulated under permit system in this reserve. There were three other reserved forests in this range in which grazing was regulated under the kancha system. Attempts were made to introduce the kancha system in this reserve but they were unsuccessful. Up to the end of the year 1918 to 1919 the rates for the different classes of animals were sheep 2 annas, cows 4 annas and buffalœs 6 annas.

64. The people of the island were very troublesome and as their cattle were not attended by herdsman with permits, it appeared obvious that very many fewer cattle were licensed than actually grazed. As a punishment apparently for this evasion to pay their proper dues punitive rates four times the above rates were levied in 1919–20 and 1920–21.

65. Due to these punitive rates and to the Forest staff detecting a considerable number of cases the villagers assumed a more chastened attitude and came to realize that they would have to pay a reasonable rate for their grazing. On account of cattle not being accompanied by a herdsman it was impossible to check the cattle grazing in the reserve. All cattle must resort to the reserve to graze at some time of the year. Hence it was decided that grazing fees should be collected at the rates of 4 annas a sheep, 8 annas a cow and 12 annas a buffalo and to the number in each village as shown in the most recent revenue census. The inhabitants of the island accepted this system and it is in force until now. It was approved with effect from 1st July 1922 in G.O. Mis. No. 269, Development, dated 12th February 1924.

66. Since then an innovation has crept in which apparently has no authority. Instead of relying on the census taken by the Revenue Department, the Forest subordinates in the island have been ordered to take a census of cattle in each village during the months of July and August and on the figures so obtained grazing revenue is collected from each villager according to the number of cattle he possesses as enumerated by the Forest subordinate and on their paying a receipt in C. Form 140 is granted. This variation is open to the very serious objection that the census is taken by the Forest subordinates who are likely to vary the numbers at their will. Also the villager when he sees the census being begun in the village will promptly release some of the cattle which will remain in the forest until the census is over. It appears advisable to accept the census of the revenue officials who are disinterested and as it is compiled for statistical purposes, is likely to be more accurate. The revenue census is taken once in five years and this figure will suffice for each year until a new census is taken.

TAMIL LIST.

Vernacular name (Tamil).	Botanical name.
Acha	*Hardwickia binata.*
Adamaruthu	*Bridelia retusa.*
Adukkuvagai	*Dalbergia paniculata.*
Aiyinipila	*Artocarpus hirsuta.*
Alampanei	*Arenga wightii.*
Alanji	*Alangium lamarckii.*
Ala	*Ficus bengalensis.*
Ambalam	*Spondias mangifera.*
Anachorian	*Laportea crenulata.*
Andimirian	*Carallia integerrima.*
Anparuthi	*Trema orientalis.*
Arasu	*Ficus religiosa.*
Arali	*Mappia fœtida.*
Arippu	*Lantana sp.*
Athankottai	*Elæocarpus oblangus.*
Athi	*Bauhinia racemosa.*
Attanarikongu	*Pygeum wightianum.*
Avaram	*Cassia auriculata.*
Ayili	*Holoptelea integrifolia.*
Ayma	*Careya arborea.*
Champakam	*Michelia champaka.*
Cherupinnai	*Calophyllum trapezifolium.*
Chinnagil	*Dysoxylon beddomei.*
Chinnathovarai	*Diospyros microphylla.*
Chittalei polavu	*Pterospermum rubiginosum.*
Do. Vagai.	*Albizzia rodoratissima.*
Chokla	*Aglaia roxburghiana.*
Eacham	*Phœnix farinifera.*
Do.	*Do. sylvestris.*
Eeta	*Ochlandra brandisii*
Do.	*Ochlandra travancorica.*
Elandai	*Zizyphus jujuba.*
Etti	*Strychnos nuxvomica.*
Ezilaipalai	*Alstonia scholaris.*
Ilavam	*Eriodendron anfractuosum.*
Irambali	*Maba buxifolia.*
Iramparathan	*Ficus asperrima.*
Do.	*Plectronia didyma.*
Kadukkai	*Terminalia chebula.*
Kaka odai	*Acacia latronum.*
Kaka usil	*Odina wodier.*
Kalmanikkam	*Anaco'osa densiflora.*
Kalunnu	*Grewia hirsuta.*
Kanakamuku	*Pinanga dicksonii.*
Kanthapanai	*Bentinckia coddapanna.*
Karai	*Randia dumetorum.*
Do.	*Elæodendron glaucum.*
Karagil	*Amoora canarana.*
Kara Indu	*Pterolobium indicum.*
Karanjili	*Dipterocarpus bourdillonii.*
Karlikotte	*Zizyphus glabrata.*
Karimaruthu	*Terminalia paniculata.*
Karodai	*Acacia latronum.*
Karukatan	*Zizyphus trinervia.*
Karumkongu	*Balanocarpus utilis.*
Karum kunthrikam.	*Canarium strictum.*
Karumthovarai	*Diospyros bourdillonii.*
Karungali	*Acacia sundra.*
Karunthali	*Diospyros assimilis.*
Katillepai	*Bassia longifolia.*
Kattuchampakam	*Evodia roxburghiana.*
Kattucherai	*Holigarna arnottiana.*
Kattu karuveppilai.	*Murraya exotica.*
Kattu murukku	*Zanthoxylum rhetsa.*
Kattupuvan	*Nephelium longana.*
Kattu veppilai	*Clausena wildenovii.*
Kelakai	*Carissa carandas.*
Kodukapuli	*Garcinia cambogia.*
Kola aiyila	*Anthocephalus cadamba.*
Kolakkattai Teku.	*Premna tomentosa.*
Kolamaruthu	*Terminalia arjuna.*
Kolam	*Machilus macrantha.*
Kolavu	*Hardwickia pinnata.*
Kongu	*Hopea parviflora.*
Konnai	*Cassia fistula.*
Koonthapanai	*Caryota urens.*
Kottai	*Zizyphus œnoplia.*
Do.	*Do. xylopyrus.*
Kulapanai	*Glycosmis pentaphylla.*
Kumil	*Gmelina arborea.*
Do.	*Do. asiatica.*
Kundumani	*Abrus precatoris.*
Kurinja	*Strobilanthes sp.*
Kusavi	*Meliosma arnottiana.*
Lavangam	*Cinnamomum zeylanicum.*
Maa	*Mangifera indica.*
Madagiri Vembu	*Chuckrassia tabularis.*

Vernacular name. (Tamil).	Botanical name.
Madama	*Buchanania latifolia.*
Mahilamaram	*Mimusops elengi.*
Makki	*Garcinia morella.*
Malainarathei	*Atalantia monophylla.*
Malamanjadi	*Ormosia travancorica.*
Malankonnai	*Acrocarpus fraxinifolius.*
Manikulukki	*Agrostistachys longifolia.*
Manja kadambai	*Adina cordifolia.*
Manja konnai	*Cassia siamea.*
Manjanathi	*Morinda citrifolia.*
Manjanathi	*Morinda tinctoria.*
Maravetti	*Hydnocarpus alpina.*
Maravuri	*Antiaris toxicaria.*
Marul	*Sansevieria zeylanica.*
Mattipal	*Ailanthus malabarica.*
Mavalingam	*Cratæva religiosa.*
Milachadayan	*Bischofia javanica.*
Moongil	*Bambusa arundinacea.*
Morusarakodi	*Hippocratea indica.*
Mullilavu	*Bombax malabaricum.*
Mullumurukku	*Erythrina indica.*
Mullkiluvai	*Balsamodendron berryi.*
Munthrikottai	*Anacardium occidentale.*
Muringa	*Moringa pterygosperma.*
Mylai	*Vitex altissima.*
Naiteku	*Dillenia pentagyna.*
Naman	*Angeissus pendula.*
Nangu	*Mesua ferrea.*
Naranabali	*Podocarpus latifolia.*
Narathai	*Xanthophyllum flavescens.*
Nariveli	*Ehretia lævis.*
Naval	*Eugenia jambolana.*
Nedunar	*Polyaltha cerasoides.*
Do	*Do· fragrans.*
Neikottai	*Sapindus emarginatus.*
Nelli	*Phyllanthus emblica.*
Nettai lingam	*Polyaltha longifolia.*
Nirkadambe	*Stephegyne parvifolia.*
Nirnaval	*Eugenia gardneri.*
Nirusil	*Albizzia stipulata.*
Nirvetti	*Aporosa acuminata.*
Odai	*Acacia planifrons.*
Odankodi	*Combretum ovalifolium.*
Olakapalai	*Mimusops hexandra.*
Olankarai	*Elæocarpus serratus.*
Pacha kiluvai	*Protium caudatum.*
Pachale	*Dalbergia paniculata.*
Palvadinjan	*Palaquium ellipticum.*
Panei	*Borassus flabelliformis.*
Panichi	*Diospyros embryopteris.*
Panni vagai	*Albizzia lebbek.*
Parambai	*Prosopis spicigera.*
Parambu	*Calamus rotang.*
Pavetta	*Pavetta indica.*
Pee maram	*Ailanthus excelsa.*
Pei kadukai	*Terminalia travaencorensis.*
Pila	*Artocarpus integrifolia.*
Pinnai	*Calophyllum elatum.*
Pira	*Streblus asper.*
Pira muttipala	*Aglaia minutiflora.*
Ponpathiri	*Stereospermum chelonoides.*
Porasu	*Butea frondosa.*
Puli	*Tamarindus indica.*
Pullavaram	*Mundulea suberosa.*
Pumpadri	*Dolichandrone crispa.*
Pungam	*Pongamia glabra.*
Punnai	*Calophyllum inophyllum.*
Puthangali	*Pœciloneuron indicum.*
Puvan	*Schleichera trijuga.*
Ruthracham	*Elæocarpus tuberculatus.*
Sadangu	*Heritiera papilio.*
Santhanam	*Santalum album.*
Santhana vembu	*Cedrela toona.*
Sappan	*Cæsalpinia sappan.*
Senkurinji	*Gluta travancorica.*
Senthanuku	*Sterculia urens.*
Sheithi	*Vernonia monosis.*
Shemanathi	*Erythroxylon monogynum.*
Shempuvan	*Nephelium longana.*
Shenkottai	*Semecarpus anacardium.*
Sherankottai	*Do.*
Sheyakkai	*Acacia concinna.*
Sorapalai	*Notophegia colebrookiana.*
Tani	*Terminalia belerica.*
Thanthapalai	*Wrightia tinctoria.*

TAMIL LIST—*cont.*

Vernacular name. (Tamil.)	Botanical name.
Tanuku ..	*Cochlospermum gossypium.*
Do. ..	*Gyrocarpus jacquini.*
Tavatte polavu	*Croton malabaricun.*
Tekku ..	*Tectona grandis.*
Tettankottai	*Strychnos potatorum.*
Thalai ..	*Pandanus tectorius.*
Thonthe ..	*Baccaurea courtallensis.*
Thothagathy	*Dalbergia latifolia.*
Tirukalli ..	*Euphorbia tirucalli.*
Unnu ..	*Grewia lævigata.*
Do. ..	*Do. leptopetala.*
Usil ..	*Albizzia amara.*
Vadathalai	*Dichrostachys cinerea.*
Vaimaram ..	*Chloroxylon swietenia.*
Vakkanai ..	*Diospyros montana.*
Valamburi ..	*Helicteres isora.*
Vattakanni	*Macaranga roxburghii.*
Vattapolavu	*Pterospermum glabrescens.*
Vedipila ..	*Cullenia excelsa.*
Vegula chokla	*Aglaia courtallensis.*
Vekkali ..	*Anogeissus latifolia.*
Vellagil ..	*Dysoxylum malabaricum.*
Vellai indu	*Acacia pennata.*
Vellaikunthrikam	*Vateria indica.*
Vellathi ..	*Bauhinia malabarica.*
Vella thovarai	*Diospyros foliolosa.*
Do.	*Do. insignis.*
Do.	*Do. orixensis.*
Vellelembu	*Hemicyclia venusta.*
Velvel ..	*Acacia leucophlœa.*
Vembadam ..	*Ventilago madraspatana.*
Vembu ..	*Azadirachta indica.*
Vengai ..	*Pterocarpus marsupium.*
Vilamaram	*Feronia elephantum.*
Vilvam ..	*Aegle marmelos.*
Virali ..	*Dodonæ viscosa.*
Virusham ..	*Cordia myxa.*
Viruvettai ..	*Dalbergia multiflora.*

Proceedings of the Chief Conservator of Forests

Proceedings No. 559, Press, 21st December 1935

Working Plan—Tinnevelly Forests—Sanctioned.

T. A. WHITEHEAD, Esq., I.F.S.,
Acting Chief Conservator of Forests.

READ—the following papers :—

Letters from the Conservator, Working Plans Circle, dated 6th April 1935, and 27th November 1935, No. A. 297/31.

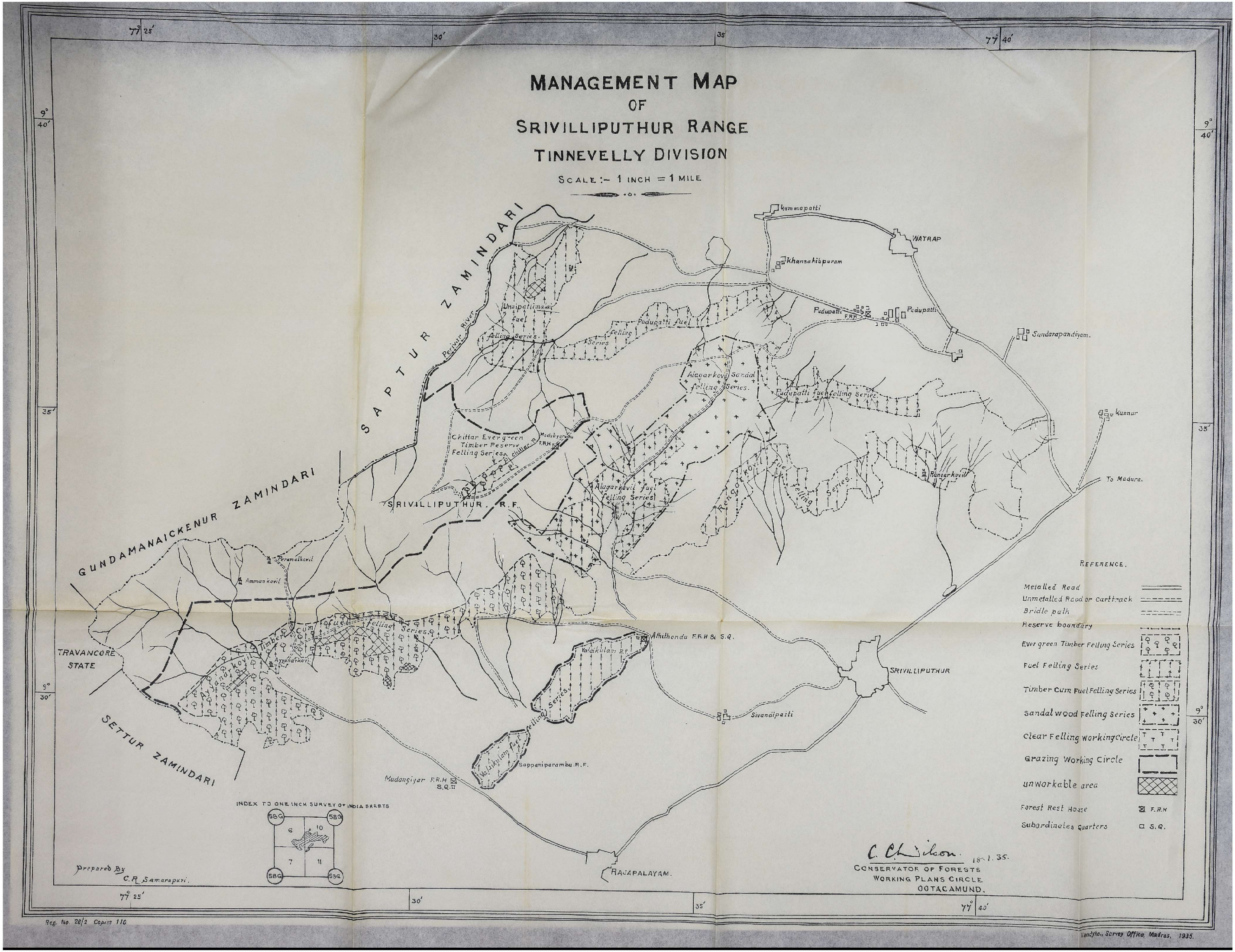
Proceedings—No. 559, Press, dated 21st December 1935.

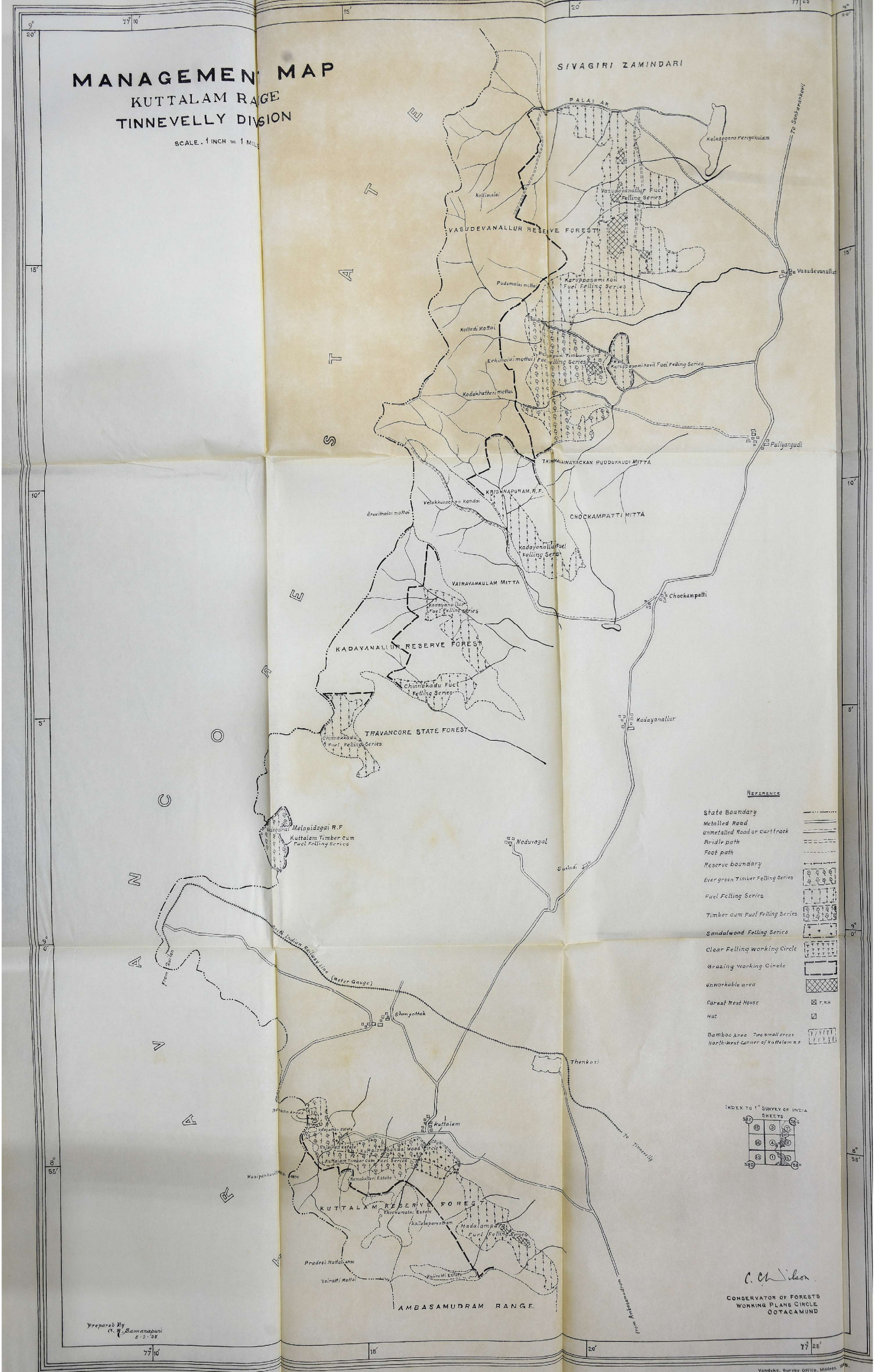
Sanctioned.

T. A. WHITEHEAD,
Acting Chief Conservator of Forests.

To the Conservator of Forests, Working Plans Circle.
,, Conservator of Forests, Coimbatore Circle.
,, District Forest Officer, Tinnevelly.
,, Collectors of Tinnevelly and Ramnad.

Copy to other Conservators of Forests.
,, all other District Forest Officers.
,, the Principal, Madras Forest College.
,, the Working Plan Officers.
,, the Provincial Sylviculturist.
,, the President, Forest Research Institute, Dehra Dun.

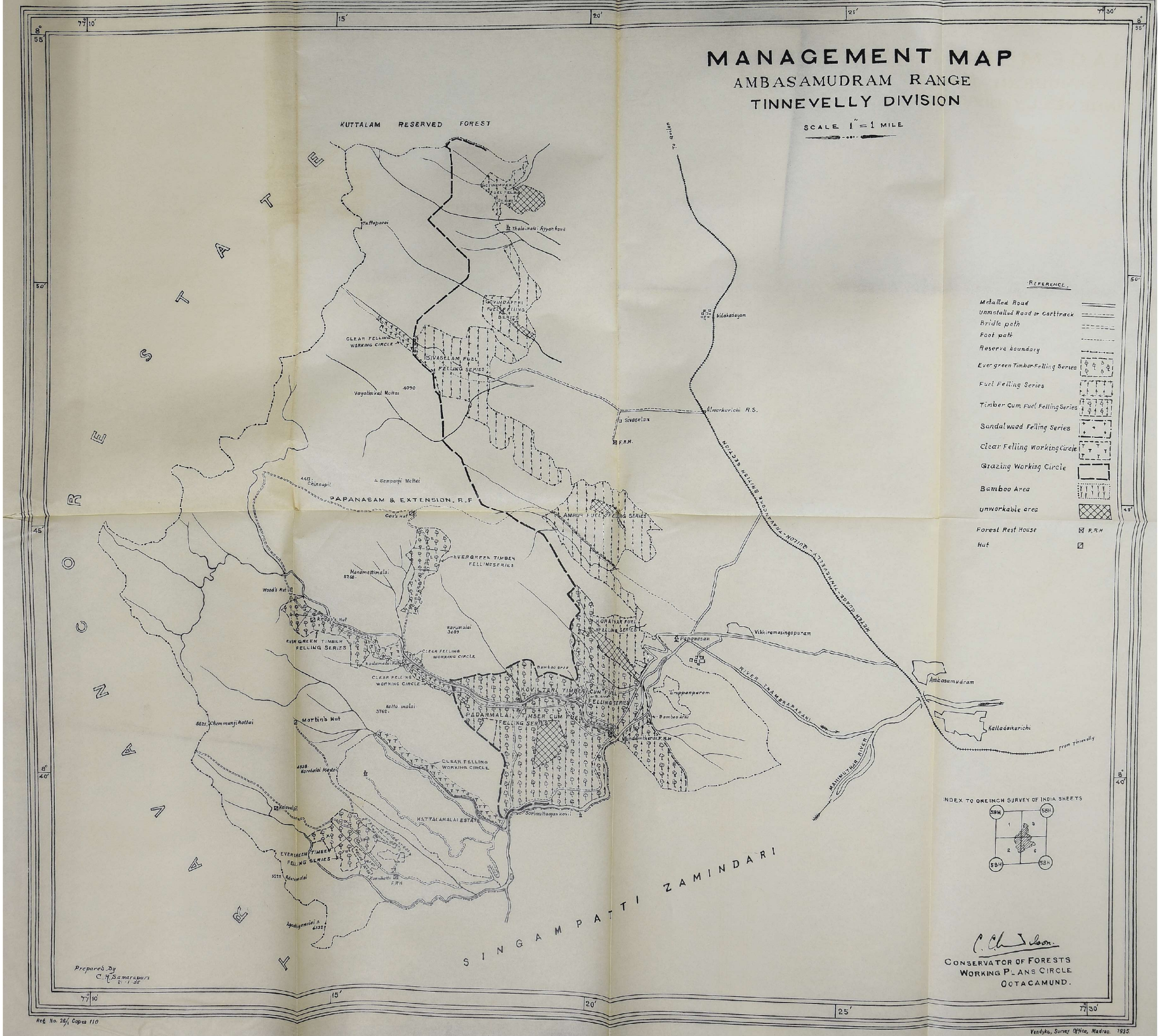

MANAGEMENT MAP
OF
SRIVILLIPUTHUR RANGE
TINNEVELLY DIVISION
SCALE :- 1 INCH = 1 MILE
SAPTUR ZAMINDARI
GUNDAMANAICKENUR ZAMINDARI
TRAVANCORE STATE
SETTUR ZAMINDARI
Periyar River
Unaipatlimalai fuel felling Series
Puduppatti fuel felling Series
Alagarkovil Sandal felling Series.
Puduppatti fuel felling Series
Chittar Ever green Timber Reserve Felling Series
Alagarkovil fuel felling Series
Rengarkovil fuel felling Series.
SRIVILLIPUTHUR. R.F.
Timber cum fuel felling Series
Ayyanarkovil
Valaikulam R.F.
Valaikulam fuel felling Series
Sappaniparambu R.F.
Kummapatti
WATRAP
Khansahibpuram
Pudupatti F.R.H.
Pudupatti
Sundarapandiyam.
Kunnur
To Madura.
Rangarkovil
Peramalkovil
Ammankovil
Athithondu F.R.H & S.Q.
SRIVILLIPUTHUR
Sivandipatti
Mudangiyar F.R.H S.Q.
RAJAPALAYAM.
INDEX TO ONE INCH SURVEY OF INDIA SHEETS
58G 58G 58G 58G
6 10 7 11
REFERENCE.
Metalled Road
Unmetalled Road or carttrack
Bridle path
Reserve boundary
Ever green Timber Felling Series
Fuel Felling Series
Timber cum Fuel Felling Series
Sandal wood Felling Series
Clear Felling Working Circle
Grazing Working Circle
unworkable area
Forest Rest House F.R.H
Subordinates Quarters S.Q.
Prepared By C.R. Samarapuri.
C. C. Wilson. 18.1.35.
CONSERVATOR OF FORESTS
WORKING PLANS CIRCLE
OOTACAMUND.
77° 25′
30′
35′
77° 40′
9° 40′
35′
9° 30′
Reg. No 28/2 Copies 110
Vandyke., Survey Office, Madras, 1935.



Reg. No. 26/3. Copies.110

Vandyke, Survey Office, Madras. 1935.

MANAGEMENT MAP
NANGUNERI RANGE
TINNEVELLY DIVISION
SCALE :- 1 INCH = 1 MILE
WESTERN PART OF THE RANGE.
EASTERN PART OF THE RANGE
REFERENCE
Metalled Road
Unmetalled Road or Carttrack.
Bridle path
Foot path
Reserve boundary
Ever green Timber Felling Series
Fuel Felling Series
Timber cum Fuel Felling Series
Bamboo Area
Unworkable area
Grazing Working Circle.
Forest Rest House
SINGAMPATTI ZAMINDARI
TRAVANCORE STATE
KALAKAD & EXTN. R.F
KALAKAD TIMBER CUM FUEL FELLING SERIES
TAMBRAPARNI RIVER
SRIVAIKUNTAM
SOUTH INDIAN RAILWAY LINE
KADAMBA KULAM
KUDIRAIMOLITERI R.F.
INDEX TO ONE INCH SQ.I SHEETS
Prepared By C. R. Samarapuri Draftsman 14.2.35
CONSERVATOR OF FORESTS WORKING PLANS CIRCLE OOTACAMUND.


MANAGEMENT MAP
AMBASAMUDRAM RANGE
TINNEVELLY DIVISION
SCALE 1" = 1 MILE
KUTTALAM RESERVED FOREST
TRAVANCORE STATE
SINGAMPATTI ZAMINDARI
PAPANASAM & EXTENSION. R.F
SIVASELAM FUEL FELLING SERIES
GOVINDAPPERI FUEL FELLING SERIES
CLEAR FELLING WORKING CIRCLE
AMBUR FUEL FELLING SERIES
EVERGREEN TIMBER FELLING SERIES
KURAIYAR FUEL FELLING SERIES
PADARMALAI TIMBER CUM FUEL FELLING SERIES
KATTALAMALAI ESTATE
Papanasam
Vikkiramasingapuram
Ambasamudram
Kalladaikurichi
Alwarkurichi R.S.
Sivaselam
To Quilon
From Tinnevelly
RIVER TAMBRAPARANI
MANIMUTHAR RIVER
METER GUAGE - TINNEVELLY - QUILON - TRAVANCORE BRITISH SECTION
Martin's Hut
Wood's Hut
Cox's Hut
REFERENCE.
Metalled Road
Unmetalled Road or Carttrack
Bridle path
Foot path
Reserve boundary
Ever green Timber Felling Series
Fuel Felling Series
Timber Cum Fuel Felling Series
Sandalwood Felling Series
Clear Felling Working Circle
Grazing Working Circle
Bamboo Area
Unworkable area
Forest Rest House F.R.H
Hut
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WORKING PLANS CIRCLE
OOTACAMUND.
Prepared By
C. H. Samarapuri
21-1-35
Reg. No. 26/ Copies 110
Vandyke, Survey Office, Madras. 1935.